JUN 1 1935

Engineering News-Record

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Handling 100,000 Men On Relief Construction

An account of how New York City spends ten million dollars a month on relief works, giving jobs instead of charity, getting new community assets instead of a dole-depressed army of unemployed

Also in This Issue:

THE NEW CHICAGO STOCKYARDS AMPHITHEATRE

PLANS FOR THE RIO GRANDE--PANAMA HIGHWAY

LONG INTERCEPTING SEWER AT CUMBERLAND, MD.

CHANGES IN MISSISSIPPI REVETMENT PRACTICE

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Lest Unwise Sharing Kill Production---I

THIS page is a bit off the beaten path. It is inspired by all the talk to which we recently have been treated on the subject of "share-the-wealth" and by the interest that some of our people have been taking in it. Now this always will be an engrossing theme, one that must strike a responsive chord in the hearts of men. Each of us wants his share of the wealth and each would be glad to have the sharing done so that his slice would be a little fatter than it has been hitherto. But, unfortunately, this popular job cannot be done quite so readily as some of the master-sharers would have us believe.

In the first place, it is impracticable to share the wealth in a literal sense. An enormous part of the national wealth is of such a nature that it could not be carved up for distribution. Even though we assume that unimproved land might be so divided it is manifest that the buildings, factories, utilities and other structures of industry cannot be. Obviously no one would want as his share several cubic yards of concrete or a couple of tons of used structural shapes or a set of rolls from a rail mill. As such, the distributed wealth would be all but worthless. Such industrial wealth derives its value, first from its balanced integration into a productive unit, second from the skill with which its product has been selected, designed and commended to those who may need it. In other words, the essence of industrial wealth is its *productivity*, its income-producing power, rather than any quality inherent in itself.

SO what the "share-the-wealth" advocates really mean is "share-the-income." They would arrange to distribute on some new basis the outstanding claims to the productivity of our wealth rather than divide up the existing wealth itself.

Right here it would be well to admit that all this is a legitimate field for study by the economist, the statesman and, above all, the engineer. Between them, the scientist and the engineer are more responsible than anyone else for the amazing increase in our productive capacity that has been wrought during the last century. In their successful conquest of man's age-long menace of scarcity and in the abundance they have made possible, is found the germ of this secondary problem. Now, given our abundance, we must be sure that we distribute it so as to realize the highest standards of living for the largest number and assure the stable and continuous functioning of the productive system. Here is a pressing problem, not merely so desperate as the former problem of scarcity, but none the less one that must be dealt with in the interest of continued progress.

But in grappling with it we dare not forget that if we would share an abundance we first must make certain of the abundance. It would get us nowhere if, in our efforts to distribute rationally the abundance we have learned how to create, we should destroy those forces upon which we must rely to continue its creation. It is on the *continuous* process of production and distribution that we must rely for stability and higher standards of living, not on the one-time distribution of the accumulated wealth at some designated moment.

AND it is the danger of destroying the incentives responsible for this continuity of productive effort that is underestimated by some of those who advocate radical changes in our methods of distributing income.

Willard Chevalier

(To be concluded next week)

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In the News:

Wage Rates under the Emergency Relief Act of 1935, announced last week, caused an immediate outcry from representatives of organized labor as being so low as to depress all wage rates. Careful study of the rates and regulations has caused the storm to die down. They do not apply to highway and crossing-elimination work nor to PWA work on federal buildings. They will apply chiefly to operations such as the FERA carried on last winter, and on these operations they are not much below FERA rates and are claimed to provide an actually higher monthly income.

PWA Loans and Grants for non-federal work are to be liberalized. The new basis is 45 per cent grant and 55 per cent loan at 3 per cent interest. It is hoped in this way to get more cities to undertake public-works construction on the loan-grant basis, thus reducing the direct load of relief work.

Wisconsin, which presented a statewide relief-works program to the federal government and received an allotment of $100,000,000, subject to the raising of a like amount and the passage of enabling legislation, is deeply engrossed in the legislation. The movement is significant from a state planning viewpoint.

Mayor La Guardia's Proposal for a $45,000,000 municipal power plant in New York, with the expressed purpose of forcing lower rates from the existing private power company, was voted down by the Board of Estimate but later made the subject of a public hearing to be held on June 5.

Dallas, for the first time in history, watched a major flood flow down its Trinity River without inundating all of its low-lying sections. The new levee system is reported to have worked perfectly, confining the worst flood in twelve years.

A New PWA Loan and Grant Allotment was made last week to Danville, Va., for construction of a hydro-electric plant. It is for $2,750,000 as compared with $3,000,000 allotted on another set of plans in 1933 but rescinded after a municipal bond issue was turned down by the voters.

The Relief-Works Program will be administered through 307 districts created last week by Harry L. Hopkins, Works Progress Administrator. So far as possible each district in a state contains an equal number of families on relief. District administrators will report to a state works progress administrator, who will report to Mr. Hopkins.

Operations at Grand Coulee are pointing toward a start on the concreting work about Sept. 1. One step, construction of the gravel washing plant, has begun. Excavation continues at a fast pace, over 230,000 cu.yd. being moved over the belt conveyors in a week's time.

In This Issue:

Unusual Structural Framing in both steel and reinforced concrete is found in the New International Amphitheatre at the Union Stockyards in Chicago.

Congress has appropriated to date a total of $175,000 for surveys on the proposed through highway from the Rio Grande to Panama. The engineering work involved is described in a report by the U. S. Bureau of Public Roads.

Aerial Surveys play an important part in reconnaissance of the projected Rio Grande-Panama highway. The methods employed are outlined in a statement supplementing the summary of the official report.

Cumberland, Md., is building a long intercepting sewer, partly in the bed of the old C&O Canal, to eliminate the nuisance caused by discharging sewage into open channels. Finding adequate foundations within reasonable limits was one of the major problems.

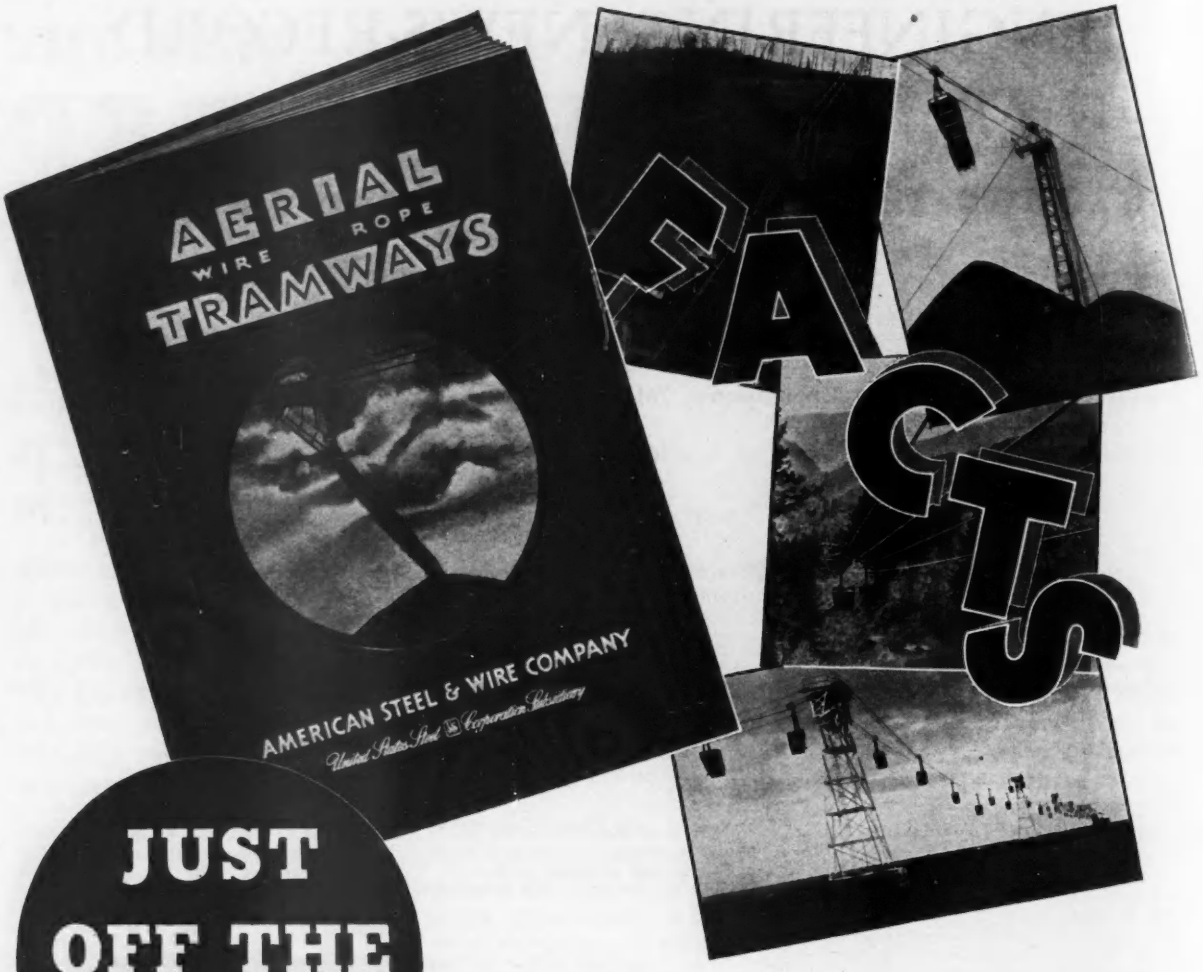
Significant engineering developments in foreign fields are reviewed in another group of abstracts of articles published abroad.

Handling 100,000 Men on relief-works projects, as is being done under engineering direction in New York City, has developed into a construction-management problem of unusual complexity.

Articulated Concrete Blocks have been used for revetments along the Mississippi River for several years. Experience in their use has brought about changes that are described in this issue.

Coming Articles:

Among College Research Laboratories, none ranks higher in accomplishment or contributions to knowledge and progress than the Engineering Experiment Station at the University of Illinois. Its program of research is always varied and usually large and significant. Next week an article will describe current investigations and will indicate the nature of the results, so far as they are available or can be predicted.



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ENGINEERING NEWS-RECORD

May 30, 1935

FIG. 1—FRAMED with rolled-steel-section arches of 197-ft. span, the new home of the International Livestock Show in Chicago provides seats for 10,000 spectators.

Striking Structural Framing in Chicago Exhibition Building

New International Amphitheatre at Union Stockyards comprises steel pavilion 200x310 ft. and two concrete wings 165x310 ft.—Steel arches of 197-ft. span made of 36-in. 300-lb. rolled sections—Thrust of series of 51-ft.-span concrete arches resisted by horizontal reinforced-concrete yoke enclosing each wing

THE extensive reconstruction of buildings, elevated lines, livestock bridges and other structures occasioned by the disastrous fire at the Chicago Union Stockyards on May 19, 1934, included an entirely new exhibition building to replace the old amphitheatre, home of the famous International Live Stock Exposition. Inasmuch as the exposition was scheduled for Dec. 1, only about six months' time was available to make complete designs, take bids and construct the new facilities. Not only was the work completed in this unusually short period, but a structure resulted that is remarkable in many of its structural aspects.

The new International Amphitheatre group, 310x530 ft. in plan, consists of a central pavilion 200 ft. wide and 310 ft. deep, flanked on either side by two-story exhibit wings each 165x310 ft. in plan. In the pavilion, two-hinged arches of 197-ft. span, fabricated from the heaviest rolled girder-beam sections available, carry the roof, the cantilever balcony of the main amphitheatre, and two floors and roof of the adjacent 16-ft. bays in the wing buildings. In the wings, roof bents consist of a series of concrete arches designed as rigid frames and creating end thrusts that are resisted by the end columns and by a continuous bay of flat-roof slabs at each end in the form of horizontal girders, which act as a yoke by virtue of steel rods that run the length of the building and tie the girders together. The new pavilion seats 10,000 spectators as compared with 4,000 in the old structure which it replaces. All steel is fireproofed up to the level of the tops of the balconies; tile is used for the cantilever balconies, brick for the arch legs and concrete elsewhere.

Rolled section arches

The arches of the pavilion are of the largest span yet built, utilizing the special rolled-girder section make-up and represent the first instance in which cantilever balconies have been used in conjunction with the arches. Similar arches have been used only once before in long-span construction, namely on the University of Chicago field house built

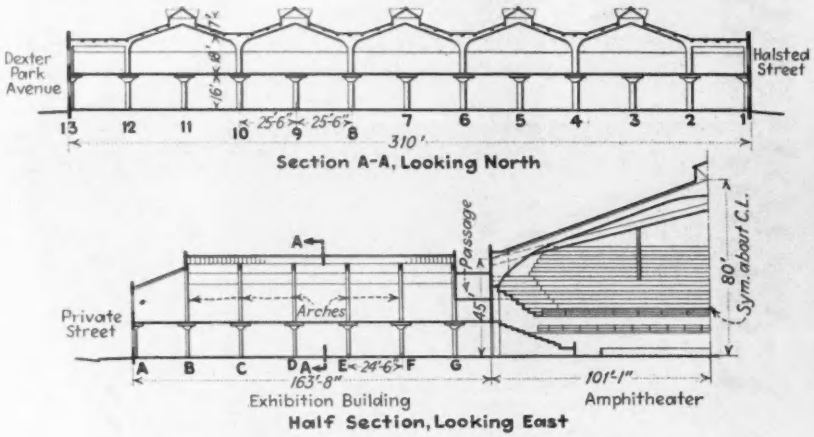


FIG. 2—SECTIONS through concrete exhibition wings and steel-framed amphitheatre of new livestock show layout at Chicago stockyards.

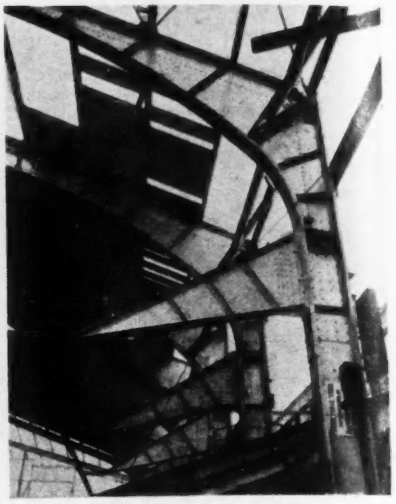


FIG. 3—ARCHES of 36-in., 300-lb. rolled sections expanded to a 10-ft. depth at the haunch by splitting the section and inserting triangular plates between the flanges. Note the 19-ft. cantilever balcony.

in 1931, where the span is 160 ft. 4 in., and the height to the bottom flange at the center is 59 ft. On the International Amphitheatre, the arches have a span of 197 ft., and a clear height of 73 ft. Eleven such arches were required, spaced 21 or 22 ft. 3 in., the variable spacing resulting from the fact that some of the old footings were used. For this type of arch with vertical legs, tierods beneath the floor are required, to resist the horizontal thrust.

As shown in Fig. 4, the basic member of the arch ribs is a 36-in., 300-lb., wide-flange section, which is split at the haunches and at the center of the span and expanded to depths of 10 and 7 ft. respectively. Elsewhere the original section is used, with or without cover-plates as required. Expanding the sections is done by splitting the 36-in. beam into a 27-in. T and a 9-in. T, and riveting two triangular-shaped side plates to the stems of the T's.

At the haunches the inner flanges are reinforced by three 16x¾-in. plates outside and two 6x¾-in. plates and two 6x6x¾-in. angles inside. This increased section continues down the vertical leg to below the balcony cantilever. Reinforcement on the outer flange at the haunch and down to below the cantilever bracket consists of three 16x¾-in. plates. At the crown the lower flange reinforcement consists of one 16x½-in. plate on the outside and two 6x¾-in. plates on the inside. The maximum moments which these increased sections are designed to resist are 3,900,000 ft.-lb. at the haunch and 1,000,000 ft.-lb. at the center, created by full roof live and dead loads in combination with full live and dead loads on the balconies.

Design loads and stresses

In calculating the arch stresses a uniform load of 1,560 lb. per ft. was used made up from 21 lb. per sq. ft. of horizontal projection for composition roofing, tile and insulation; 24 lb. per sq. ft. for roof steel, including purlins, beams and arches; and 25 lb. per sq. ft. live load, using a maximum bay of 22 ft. 3 in. [(21+24+25)×22.25=1560]. This 1560-lb. load was assumed to be divided into three equal parts: 520 lb. per foot for roof dead load; 520 lb. for structural-steel load, excluding the weight of the vertical arch legs; and 520 lb. for live loads.

For combined direct compression and bending, a basic unit stress of 18,000 lb. per sq. in. was used. In proportioning compression flanges of the arches, the unit stress was reduced to 17,000 lb. per sq. in. as a protection against temperature stresses, shortening of arch material due to direct compression, etc. In proportioning the tension flanges, a further reduction of unit stress to 15,000 per sq. in. was made, to allow for rivet holes in the main material. These reductions in the basic unit stress made it unnecessary to increase the arch material at any point due to wind loads.

In calculating thrusts, vertical reactions, flexural shearing and compressive stresses the arches, were assumed as 3 hinged for the dead weight of the structural steel work, including purlins and bracing, but excluding the weight of the balcony steel. For the remaining dead loads, for live, snow and wind loads, and for stresses due to temperature variations, two-hinged conditions were assumed. In actual practice these

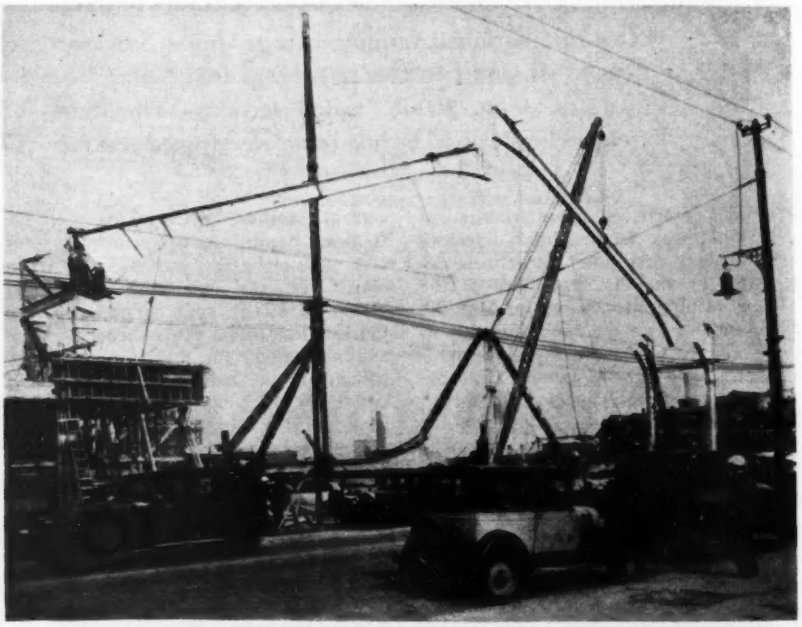


FIG. 4—ARCHES WERE ERECTED in four pieces by two stiff-leg derricks with 95-ft. booms with crawler cranes filling in the bracing and roof. Erected as three-hinged for partial dead loads, the arches were converted to two-hinged for final loads.

conditions were secured by providing a temporary pin at the peak joint of each arch that was not riveted up until all roof steel was in place and the haunch joints securely riveted. Additional control of the stresses was possible by adjustment of the tierods at the base of the arches.

Investigations were made of various arrangements of live loads on the arches (both on roof and on balconies). The maximum load on an arch leg base was found to be 622,400 lb. made up from the following combination: 153,700 lb. from full live and dead load across the arch; 94,500 lb. from full live and dead load on both balconies; 224,200 lb. from full live and dead load on the adjacent bays in the wing buildings; and 150,000 lb. from direct-compression loads in the arch legs caused by the steel itself, by encasement and by the weight of the lower tier seats. The maximum horizontal thrust at the base of the arches, and therefore the maximum load in the tierods, was found to be 107,000 lb., caused by full live and dead load across the arch (90,700 lb.), and full live and dead load on both balconies (16,400 lb.). To resist this thrust, a 3½-in. diameter tierod was used for each arch.

Special details

Among the arch details, the base, the splices and the balcony connections are worthy of note. These are illustrated on Fig. 5. The foundation plate is a slab 32x32x4½ in., with a keyway 5 in. wide and 1 in. deep, to accommodate a tongue of the 32x25x2-in. base plate that is riveted to the bottom of the arch leg, the keyway and tongue forming the arch hinge. The tierod connection is made by means of a yoke around the arch leg, consisting of 5½-in. thick bars outside and inside the leg, pulled together by two 2½-in. bolts; the 3¼-in. diameter tierod is attached to the inside bar. Four 8x8x1-inch stiffener angles are set vertically against the web as a part of this base detail, to distribute the load to the base angles, which transfer it to the base plate without requiring milling of the main section of the arch leg.

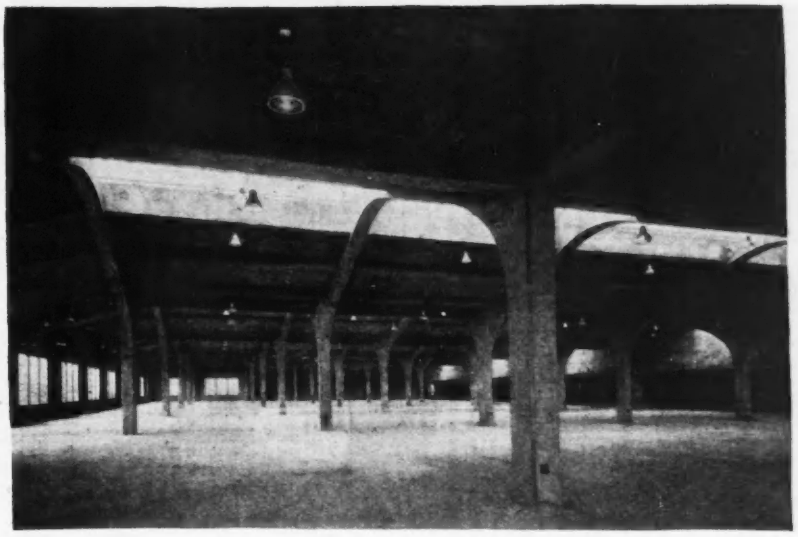


FIG. 6—CONCRETE roof arches of exhibition building. Flat-slab roof bay in foreground is designed as a horizontal girder to resist arch thrusts.

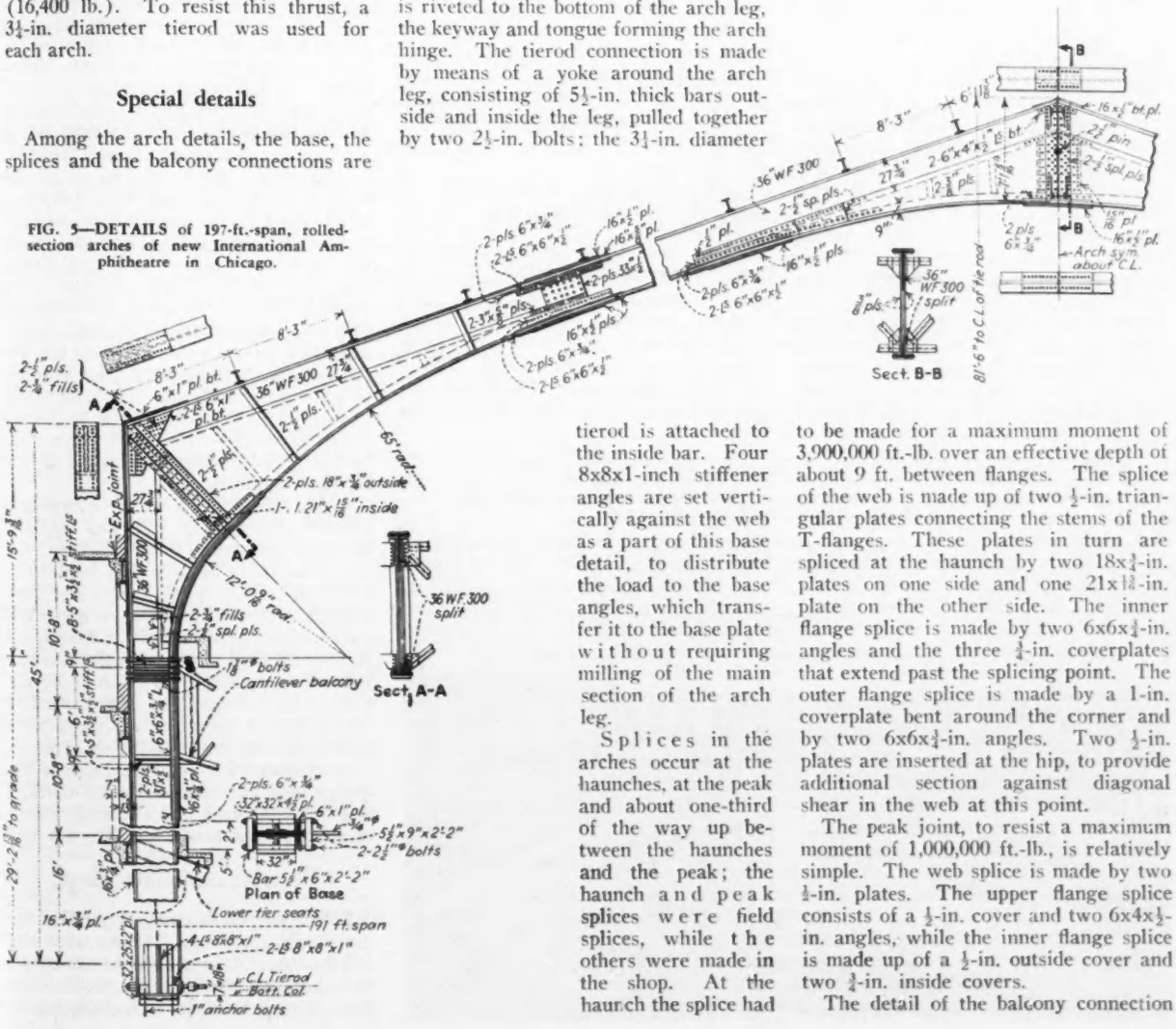


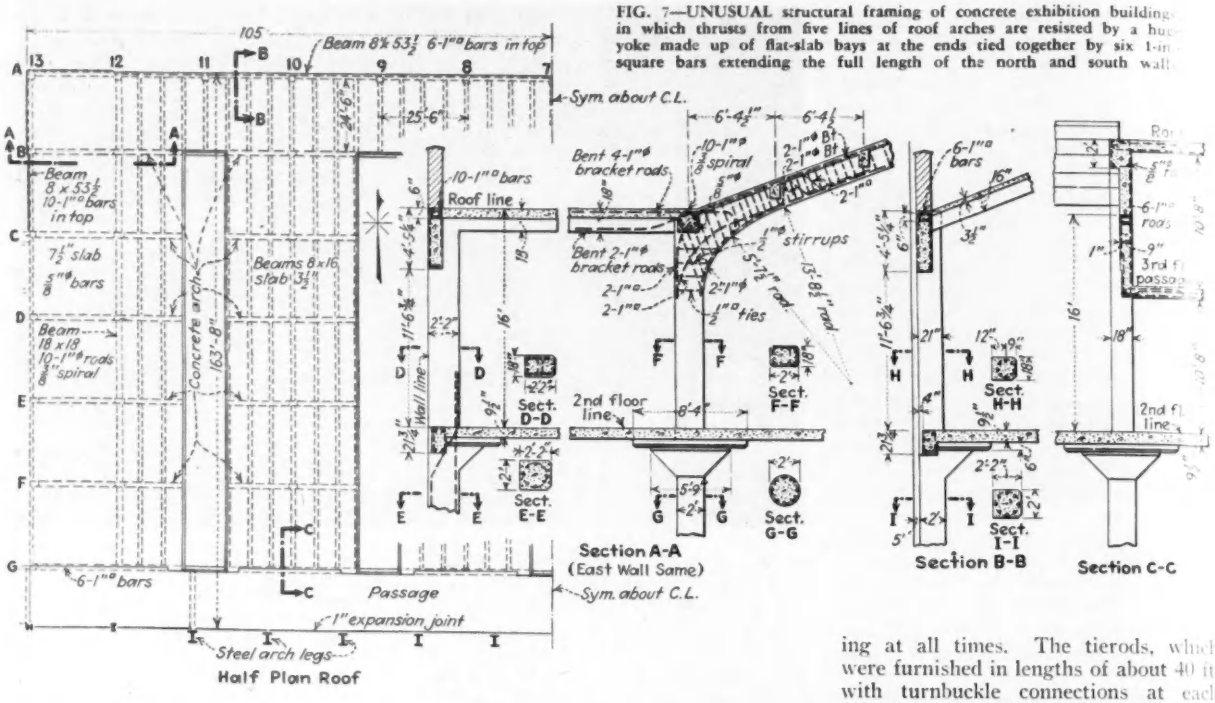
FIG. 5—DETAILS of 197-ft.-span, rolled-section arches of new International Amphitheatre in Chicago.

Splices in the arches occur at the haunches, at the peak and about one-third of the way up between the haunches and the peak; the haunch and peak splices were field splices, while the others were made in the shop. At the haunch the splice had to be made for a maximum moment of 3,900,000 ft.-lb. over an effective depth of about 9 ft. between flanges. The splice of the web is made up of two ½-in. triangular plates connecting the stems of the T-flanges. These plates in turn are spliced at the haunch by two 18x½-in. plates on one side and one 21x1⅛-in. plate on the other side. The inner flange splice is made by two 6x6x¾-in. angles and the three ¾-in. coverplates that extend past the splicing point. The outer flange splice is made by a 1-in. coverplate bent around the corner and by two 6x6x¾-in. angles. Two ½-in. plates are inserted at the hip, to provide additional section against diagonal shear in the web at this point.

The peak joint, to resist a maximum moment of 1,000,000 ft.-lb., is relatively simple. The web splice is made by two ½-in. plates. The upper flange splice consists of a ½-in. cover and two 6x4x½-in. angles, while the inner flange splice is made up of a ½-in. outside cover and two ¾-in. inside covers.

The detail of the balcony connection

FIG. 7—UNUSUAL structural framing of concrete exhibition building in which thrusts from five lines of roof arches are resisted by a huge yoke made up of flat-slab bays at the ends tied together by six 1-in. square bars extending the full length of the north and south wall.



is also shown in Fig. 5. It has an effective depth of about 6 ft. in which to develop a shear of some 107,000 lb. The tension at the top of the connection produced by the maximum moment of 1,060,000 ft. is resisted by eight 1⅜-in.-diameter high-tensile steel bolts passing through both flanges of the arch leg section. Compression at the bottom of the balcony connection is resisted by four 5x3½x½-in. angles riveted to the web of the arch leg. At the balcony connection the arch leg is made up of the 36-in., 300-lb. rolled section, two 31x½-in. web plates, three 16x¾-in. coverplates on each flange and two 6x6x¾-in. angles and two 6x¾-in. plates on the inside face of the inner flange.

Truss bracing between arches is used at the peak and haunches; also knee-angle bracing at a spacing of 16 to 24 ft. connects the roof purlins to the inner flange of the arches.

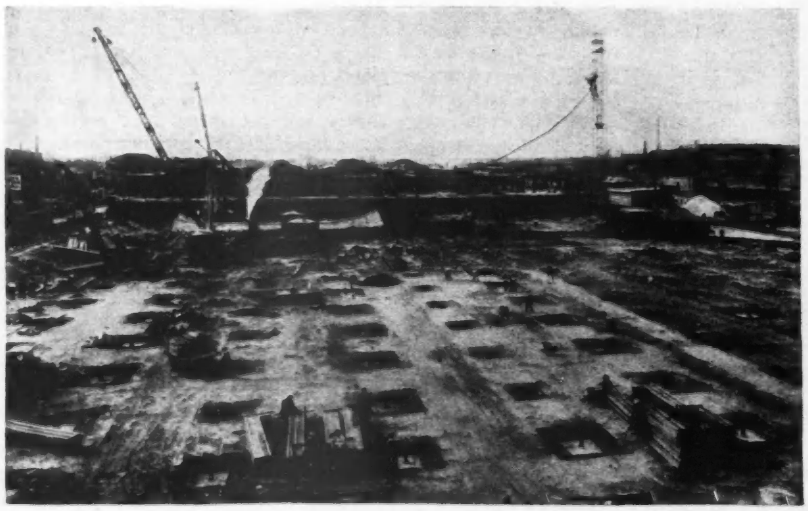
The steel arches, weighing 84 tons each, were fabricated and shipped to the site by rail in four pieces—two legs 47 ft. long and two half-roof sections 106 ft. long. The leg sections were set in place first and braced after which two stiff-leg derricks with 95-ft. booms lifted the roof sections into position. Unusual care was exercised in setting the leg sections exactly 197 ft. on centers and maintaining them at this spacing at all times. The tierods, which were furnished in lengths of about 40 ft. with turnbuckle connections at each joint, were installed and blocked up as well as held laterally in exact alignment. The tierods were adjusted gradually as the load was applied to the arches, so as to eliminate any undue stresses in the anchorbolts and footings.

The arches were erected as three-hinged, by virtue of the temporary pin at the peak joint. As the roof sections were lifted into place, the eave joints or haunches were pinned and bolted until the purlins and bracing were erected. The joints were then riveted, followed by riveting of the peak joint. No roof loads were allowed on the purlins and bracing until all steelwork was completely riveted. The pins at the peak joint took all the thrust load during steel erection and until the arches had adjusted themselves to the three-hinged condition.

With the roof framing completely riveted, the roofing tile was applied, working on both sides of the arch simultaneously, to keep the load symmetrical. Balcony girders were then erected and the concrete steps completed. Then, with all of the dead loads in place, a final stress of 83,000 lb. was induced into each of the tierods by adjusting the turnbuckles. Extensometers placed at two points on each rod were used to determine the 83,000-lb. stress.

A camber of 5 in. was used in the design, and the final deflection checked this within about ½ in. The arches were erected at the rate of about one per day.

FIG. 8—CONSTRUCTION OPERATIONS on the 530x310-ft. plot covered by the new stockyards exhibition layout at Chicago. The concrete wing building is approaching completion at far side of the plot, with steel-erection operations on the amphitheatre about to begin near the center.



Concrete exhibition wings

Either side of the central pavilion are the exhibition wings, 165 ft. wide and 310 ft. long. Of concrete construction, they are two stories high, the second floor being a 9-in. flat slab designed for

a 150-lb. per sq.ft. live load and supported by 2-ft.-diameter concrete columns in bays 24½x25½ ft. The roof over this second floor is carried by five lines of 51-ft.-span arch bents running lengthwise of the building and spaced 24½ ft. apart. The structural arrangement utilized by the designers to resist the end thrust of these arch bents is the noteworthy feature in the concrete portion of the new structure.

In effect, the five lines of arches are enclosed by a huge yoke at the elevation of the haunches. The end pieces of the yoke are the flat roof slabs of the end bays, which are designed as horizontal concrete girders. The end reactions of these girders are taken by six 1-in.-square bars extending the full length of the north and south walls of each exhibition wing. The end thrust of each row of arches is 80 kips. Of this, 50 kips is taken by the roof girder (and eventually by the tierods) and 30 kips is taken by the end-wall column in line with the arches. Of the total end thrust of 400 kips, therefore, 250 kips is taken by the girder. One half of this goes to each end, to be resisted by the six 1-in. square tierods in the walls, which accordingly are stressed to slightly over 20,000 lb. per sq.in. (125,000 ÷ 6).

In Fig. 7 the layout of the wing buildings is illustrated and details of the yoke are given. The top chord of the horizontal girder against which the arches abut is a section 18 in. square, reinforced with ten 1-in. round bars and a ⅜-in. rod spiral 14 in. in diameter. The slab or "web" of the girder is 7½ in. thick, reinforced with ⅝-in. round bars both ways, while the bottom chord or wall girder is an 8x53-in. beam reinforced in the top with ten 1-in.-square bars. Other sections in this same drawing show the arrangement of the tierods in the north and south walls.

The structural design for the International Amphitheatre was worked out under the direction of A. Epstein, consulting engineer, Chicago, who also had charge of all the other reconstruction occasioned by the fire. V. O. McClurg was retained by Mr. Epstein as consultant on the steel arches. Erection of the structural steel was carried out by the Calumet Construction Co., Chicago. The general contractor on the work, who also built the concrete wing buildings, was the Poirot Construction Co. J. M. Brandstetter is chief engineer for Mr. Epstein.

Joint Activities of National Societies Reviewed and Discussed

Major activities of the national engineering societies include administration of a research foundation and participation in research, maintenance of a large library and operation of an employment service

BRINGING TOGETHER for the first time the representatives of all the joint activities of the major national engineering societies, a dinner meeting at New York on May 20 gave an illuminating picture of the extent of cooperation among the societies and the unity of their effort that has come about during the past fifteen years. The meeting was arranged on the initiative of the officers of United Engineering Trustees, first of the joint agencies.

At the present time the number of separate bodies involved in the joint activities is eight: United Engineering Trustees, Engineering Societies Library, Engineering Foundation, American Standards Association, Engineering Societies Employment Service, American Engineering Council, Engineers Council for Professional Development and the Division of Engineering of the National Research Council.

Harold V. Coes, president, reviewed the activities of United Engineering Trustees in administering the Engineering Societies Building. The charter of the body, drawn in 1907, was framed so broadly as to enable the body to become the sponsoring or operating agency of other activities, funds, and the like, of the societies joined in the use of the building. The joint library, also formally established in 1907 but not made a reality until 1913 and greatly strengthened in 1916 with the accession of the American Society of Civil Engineers, now embraces 145,000 volumes and is used by more than 40,000 persons yearly, according to Professor Walter I. Slichter.

Engineering Foundation, created in 1914 to administer the endowment of Ambrose Swasey for the support of engineering research, administers an income of some $40,000 per year and in addition has disbursed more than $200,000 of contributions. Its field includes researches and special publications, and also educational work.

The American Standards Association is the modern form of what was organized by the societies some fifteen years ago as the American Engineering Standards Committee. It now has more than 3,000 men active in carrying on the development of some two hundred standards and safety code projects, according to Frederick E. Moskovics.

Charles Kettering, in speaking of the National Research Council, gave an enthusiastic eulogy of research as the prime motive power of progress. Lack of adequate research to develop new possibilities and new human satisfactions was the prime cause of our slowness to rebuild industrial activity, he indicated.

Prof. D. S. Jacobus then summarized the activities and methods of the engineering division of the National Research Council, illustrating its influence by referring to the Highway Research Board, created under the council's sponsorship.

What the cooperation of the societies in a joint employment service has done for the working engineer was graphically pictured by George T. Seabury. The service as such has been operating for eleven years past, though predecessor organizations existed for a number of years previously. The Western Society of Engineers joins in conducting the Chicago office, and local engineering organizations cooperate at San Francisco. During the eleven years the service has registered 33,000 engineers and has made 14,000 placements, thereby assisting one-fourth of the total membership of the societies. Of the cost of the service, three-fourths has been covered by placement fees, while the societies have contributed more than $100,000.

Summarizing the growth and achievements of the American Engineering Council, John F. Coleman sketched the breadth and importance of its functions in representing the engineering world with respect to legislation, governmental activities and projects, and studies of general public importance. Its conduct of such studies as that of waste in industry and its effective work in bringing about extension and acceleration of the basic surveys of the country received special mention.

C. F. Hirshfeld set forth the genesis of the remarkable cooperative movement for raising the level of the engineering profession that has been organized under the name "Engineers Council for Professional Development." Education and professional registration are represented in the sponsorship of this movement, in addition to engineering. Postgraduation education of the engineer and recognition of his qualifications by merited certification are objectives of the council's work, in addition to student selection and guidance and development of broader and stronger technical instruction in colleges.

Ralph Flanders, Isaiah Bowman, Harvey N. Davis, J. P. H. Perry, Arthur S. Tuttle, Chas. F. Scott, and others further discussed engineering activities and cooperation. Dr. Bowman added a reminiscence of his early days in engineering, when the late Frederick H. Newell, then chief engineer of the U. S. Geological Survey, strongly commended him for improvising an observation scaffold on a tide flat from driftwood, an experience that gave the young Bowman a decisive encouragement to progress in his career.

Rio Grande-Panama Highway Reported Practicable

Surveys, route, road sections and general engineering features as outlined in a report made by the U. S. Bureau of Public Roads

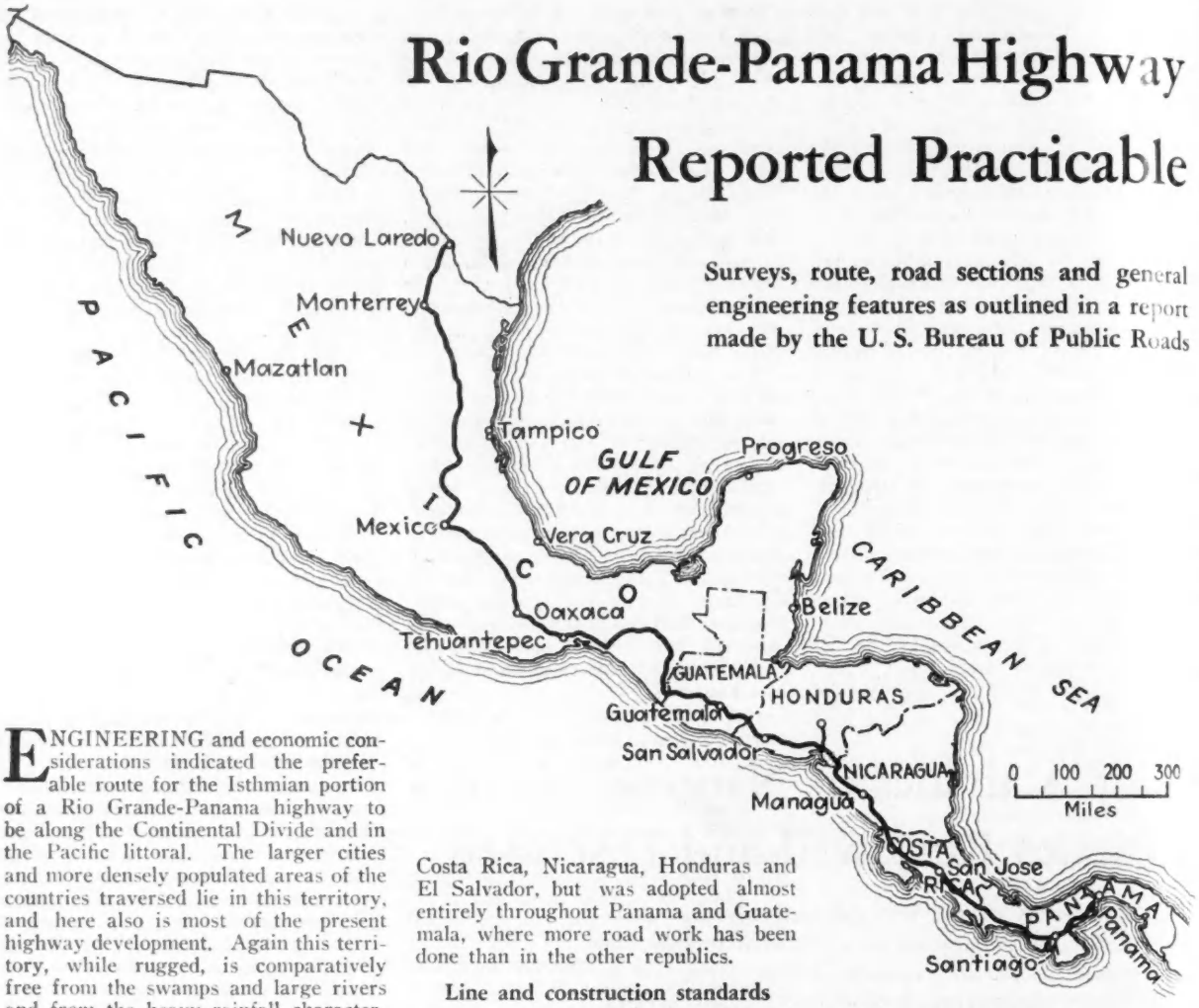


FIG. 1—PROPOSED ROAD to Panama as shown by the reconnaissance surveys of 1931-33.

ENGINEERING and economic considerations indicated the preferable route for the Isthmian portion of a Rio Grande-Panama highway to be along the Continental Divide and in the Pacific littoral. The larger cities and more densely populated areas of the countries traversed lie in this territory, and here also is most of the present highway development. Again this territory, while rugged, is comparatively free from the swamps and large rivers and from the heavy rainfall characteristic of the Atlantic slope.

Character of survey

The purpose of the survey was reconnaissance and in no sense a line location. It was therefore conducted by the most practicable means at hand. These consisted of movements on foot, on horseback, by boat and by automobile, observations on the ground and from the air, and compilation of data from records and maps. A particular feature of the work was an extensive aerial survey with two photographic planes from the Army Air Corps. An account of the aerial survey follows this summary of the official report made by the U. S. Bureau of Public Roads.

The policy followed throughout was to utilize the existing road when possible as a basis for the reconnaissance line. Alternate routes, revisions and slight deviations from the existing road where it was used as the basis for the reconnaissance are fully discussed in the report but are not shown on the map. This obviates the introduction of numerous alternate lines and revisions. Use of existing roads was not practical, however, over large sections of line in Costa Rica, Nicaragua, Honduras and El Salvador, but was adopted almost entirely throughout Panama and Guatemala, where more road work has been done than in the other republics.

Line and construction standards

The line as shown on the map (Fig. 1) is typically a reconnoitered line and is in no sense a location. It is the line that should guide future surveys and be approached by them as nearly as physical features and standards will permit without exceeding the allowable cost.

The project is entirely feasible from an engineering point of view, although it will require in many places the exercise of experience and a nice skill for the final determination of the most practical and economical location; being through tropical countries, it will embody problems that seldom, if ever, arise in temperate climates.

Alignment and Grades—Considering the terrain through which the reconnaissance survey was made, it is recommended that the ultimate minimum radius of curvature be limited to 164 ft. The ultimate maximum grade should not exceed 7 per cent. When it becomes necessary to use grades near the maximum, it is very important that the side ditches be relieved of water at intervals of not more than 300 ft.

A minimum gradient of 1 per cent is recommended when the general contour of the ground is being closely followed. In places where the roadbed is entirely on fill and the surface water can be drained to both sides, it is not objectionable to have a level grade.

Graded Section and Surfacing—The report contemplates the consideration of

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SURVEYS for the highway from the Rio Grande to Panama are now being extended with the $75,000 provided by Congress in the Hayden-Cartwright Road Act of June 14, 1934. Official consideration of this project by Congress was first taken by a resolution on March 4, 1929, authorizing an appropriation for a reconnaissance survey. Conferences of delegates of the nations interested were held in 1929 and again in 1931, and definite decision was made to adopt a route on the Pacific slope of the mountain plateau. Meanwhile, Congress by resolution of March 25, 1930, had authorized $50,000 for a route survey and preliminary studies. These were begun in the fall of 1930 and were completed in the spring of 1933. With the $50,000 authorized in the resolution of March 4, 1929, Congress has provided to date $175,000 for surveys of the Rio Grande-Panama highway. The report of the work done on the surveys completed in 1933 was made several months ago. The following general outline of the engineering determinations is taken from this report. —EDITOR.

TABLE I—DISTANCES ON INTER-AMERICAN HIGHWAY FROM PANAMA CITY, PANAMA, TO NUEVO LAREDO, N. L., MEXICO[1]

Country	Status of Road: All Weather Miles	Good or Fair in Dry Weather Miles	Passable in Dry Weather Miles	Trail Miles	Under Construction[2] Miles	Totals Miles
Panama	250.0	92.3	.....	24.8	58.1	367.1
Costa Rica	43.6	28.7	122.1	161.9	.....	356.3
Nicaragua	.....	32.6	157.9	23.5	.....	214.0
Honduras	7.5	79.9	.....	.....	13.0	87.4
El Salvador	94.6	88.6	.....	.....	.....	183.2
Guatemala	118.4	192.0	.....	.....	.....	310.4
Mexico	751.3	377.7	254.9	344.4	191.0	1,728.3
Total	1,265.4	891.8	534.9	554.6	262.1	3,246.7

[1] Nuevo Laredo, Mexico, is opposite Laredo, Tex., on the Rio Grande.
[2] Items in this column are included in the other columns.

TABLE II—CONSOLIDATED ESTIMATE OF COST OF RIO GRANDE-PANAMA HIGHWAY

Country	Length of Road Miles	Type 1	Type 2	Type 3
Panama	367.1	$2 141,260	$6,420,043	$19,407,832
Costa Rica	356.3	11,145,206	11,516,693	25,907,156
Nicaragua	214.0	5,869,546	6,187,336	14,314,089
Honduras	87.4	2,267,493	2,785,987	9,711,130
El Salvador	183.2	2,344,117	3,111,367	9,990,200
Guatemala	310.4	6,641,730	7,624,392	22,030,800
Total	1,518.4	30,409,354	37,645,822	101,361,208

The mileage to be built in Mexico and not already provided for by the Mexican government approximates 786 miles. No survey was made of this section of the route and details cannot be furnished. Basing the probable cost of the Mexican section remaining to be done on the cost of construction in similar terrain actually surveyed in this reconnaissance the costs for the 3 types of construction will be approximately as follows, in Mexico: type 1, $24,800,000; type 2, $25,400,000; type 3, $57,700,000. The total approximate cost to construct the entire route complete from Panama to the boundary of the United States at Laredo, excluding work now in progress in Mexico, will, therefore, be as follows: type 1, $55,200,000; type 2, $63,050,000; type 3, $159,060,000.

three alternate types of road surfacing: one to be constructed by the use of any satisfactory local material, another to be constructed of the same materials with an oil treatment, and one to be constructed of concrete. These are shown as types 1, 2 and 3 on Fig. 2. The first two types are to be 18 ft. wide with a graded roadbed 28 ft. between ditches except where the road is already constructed. The last is to be 20 ft. wide with a graded roadbed 32 ft. between ditches.

Drainage—Drainage structures should have a minimum clear trafficway of 20 ft. and be designed for modern truck traffic. The larger structures should be steel superstructure with masonry or concrete substructure. Smaller structures should be of masonry or concrete, the choice of which will depend largely upon the materials available at the site. Culverts should be of either concrete, masonry or portable sections, the selection of which will be governed largely by the accessibility of the location.

The above standards are taken into consideration in the estimates of costs in Table II. The estimates do not include any item for purchase of right-of-way, as it is contemplated that this will be provided for by organic law in each county.

General engineering discussion

Although the standards of line, grade and drainage structures as recommended should be the ultimate goal, it is recognized in the report that it is possible that they may not be attained in the original opening of the road. The strict adherence to them would prove costly in many places, and funds may not be available. At such places it is justifiable, for economy in the original opening of the road, to decrease the radii of curves, but in such a way that the standard minimum radii can ultimately be obtained without exceeding the maximum gradients. This is particularly applicable in mountainous sections where it will be frequently necessary to use maximum grades, some of which will be of considerable length. Should the employment of small-radii curves become unavoidable, provision should be made for ample sight distance by removal of timber, flattening of slopes and widening of the roadbed.

The same principle applies to excessive gradients as to short-radius curves. If they are used temporarily, provision should be made for their reduction without having to resort to poor alignment to secure distance.

Tangents are recommended wherever practical but are not advised if they throw the line into level terrain when slight curvature would give a location through gently rolling country, permitting the use of undulating grades and a road easily drained.

The above suggestions contemplate that the road will be opened for vehicular traffic with a minimum amount of work and the attainment of the ultimate fixed standards through gradual improvement over a period of time. The elapsed period between the time when the road first becomes usable and when it has been brought to the final standards will depend upon the demands of increased traffic and the funds available for improvement.

If it becomes necessary to proceed as above outlined, it will be found that there are sections of the road which on account of the materials encountered during the grading operations will be serviceable throughout the year. These sections may be left for further improvement in the future while other sections are being brought up to a similar or even better standard. Through such a process of gradual improvement the cost can be distributed over almost any desired period of time. Previous to the application of higher types of surfacing from time to time, the alignment and grades of the section upon which they may be placed should be brought to the original design standard.

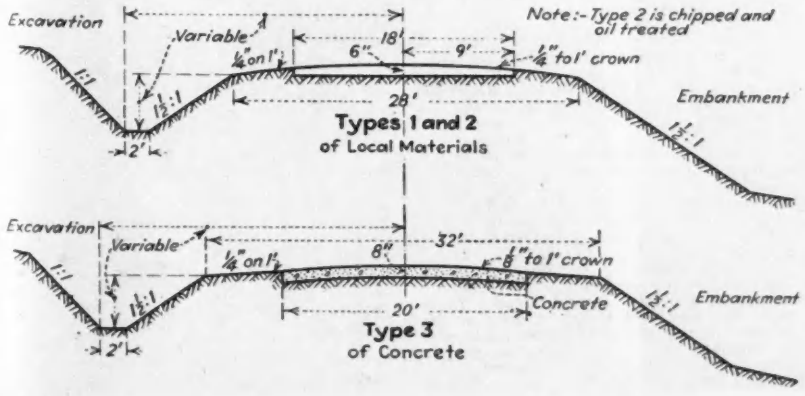
If a method of stage construction has to be resorted to, the original bridges may be constructed of timber superstructure and masonry substructure. There are in most localities many woods of satisfactory quality available. It is understood that some of them resist the ravages of insects and will remain in sound condition for ten or fifteen years.

The streams in regions having distinct wet and dry seasons are usually subject to rapid risings during the rainy season, and since the formations of their banks usually consist of sand and loam interspersed with gravel or boulders, it is of the utmost importance that bridge sites be carefully selected.

Freshets are usually of short duration, a fact that is particularly true in the upper reaches of the streams, but they reach high velocities and usually carry with them much debris and not infrequently, boulders of considerable size.

It is believed that in regions in which there is such intensive rainfall for short periods of time the policy should be adopted, where economically possible, of having an undulating grade line rather than a uniform one which makes it necessary to carry water for some dis-

FIG. 2—ROAD SECTIONS recommended for the Rio Grande Panama highway in the report of the U. S. Bureau of Public Roads.



tances in side ditches and exposes the road to the ravages of water flowing longitudinally along it.

There are so many varieties and classes of materials along the route that it is impossible to give suggestions as to which to use in any particular instance without first having made a thorough study of them. It is believed that at almost every point on the line some satisfactory material can be had.

Since there is no alternate freezing and thawing in the tropics, it will be found that there are many classes of material that will stand with practically vertical slopes. In fact many instances were recorded where existing slopes have become concave toward the center line of the road.

Within a short time a growth has sprung up on original surface near its intersection with the cut slope, and by overhanging like the eaves of a roof it prevents a great deal of wash by diverting rain water from falling directly on the slope.

Fills are frequently protected from wash by planting along them a shrub called "pinuela," which also serves as a protection for traffic.

Fences are easily constructed by setting out branches of several kinds of trees that take root and grow rapidly.

Table I gives the distances along the proposed highway from Panama to Texas. Table II gives the summarized estimate of cost of the highway from Panama to Guatemala, inclusive.

Aerial Surveys of Road Route from the Rio Grande to Panama

Methods employed in aerial survey of portions of the route for an inter-American highway to the Panama Canal

By D. Tucker Brown
Bureau of Public Roads, Washington, D. C.

THE TERRITORY covered by aerial photography on the Inter-American Highway reconnaissance surveys was necessarily limited by the funds available for the purpose. Therefore it was essential before any photographing was done to determine just what areas were to be covered. It seems advisable to describe the method by which this was done before discussing somewhat in detail the application of the photography to the general plan of reconnaissance.

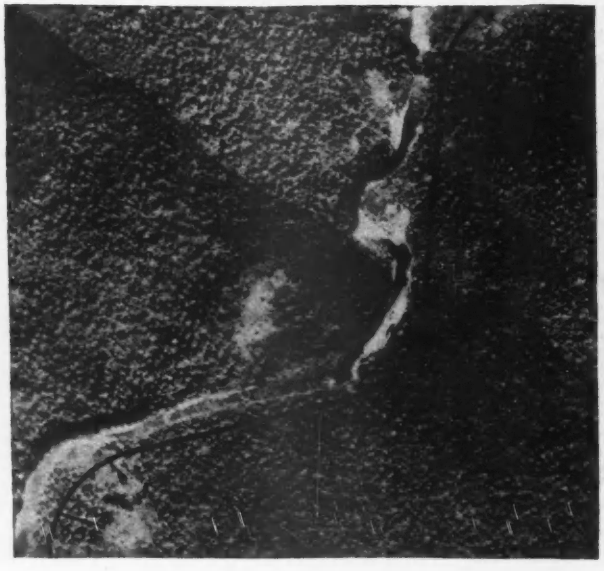
The route for the section of the highway under immediate consideration lay between the Panama Canal and the southern boundary of Mexico and somewhere within the confines of the republics of Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica and western Panama—an area of approximtely 190,000 square miles situated between the Atlantic and Pacific oceans and traversed from southeast to northwest by the Continental Divide.

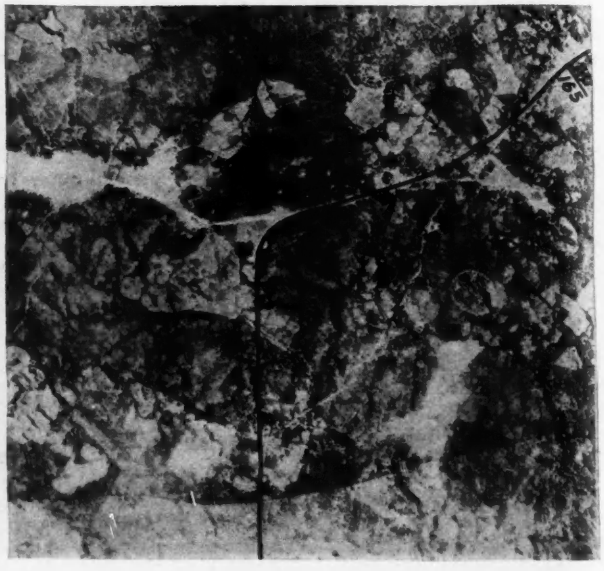
Some parts of these countries are covered with almost impenetrable and uninhabited jungle, and others are largely marshland or embody various other physical features that make them unsuitable for roadbuilding. Before it could be decided which sections were undesirable it was necessary that they be located and examined. Then a determination could be made as to the approximate bounds of the areas to be covered, by detailed investigations leading up to establishing the most feasible route for the highway.

It was thought that, without a great deal of field work, a decision could be made as to where and why the Atlantic or Pacific littoral or the Continental Divide should be occupied. This was accomplished by the use of information assembled from studies and investigations of all available maps and data relating to the meteorology, geography, geology, present roads, highways and other transportation systems, and the centers of population from local engineers and a limited number of explorations. The result was, that the general territory selected for the line reconnaissance should be principally confined to the Pacific littoral and the Continental Divide, touching the Atlantic littoral only for short distances in several of the countries.

Although over half the territory was thus eliminated from further consideration, there still remained a great deal in which there was undoubtedly much undesirable terrain, some of which could be disposed of by more or less cursory explorations and examinations. These were made from planes, excursions afoot and on horseback and by boat travel along the coast and up some of the larger streams.

As the process of reduction continued, the more favorable terrain became notably evident, and with the exception of a few very rugged and questionable areas was so narrowed that it could be photographed economically by a single properly controlled plane flight.





PICTURES TAKEN with K-3 camera over terrain where only a single flight was necessary. Location of road at left controlled by stream and, at right, by existing road.

The aerial photographs were to be used for the primary purpose of portraying the line thereon as a basis for making maps and not for selecting the line, as this was to be done on the ground.

A close ground reconnaissance was made of the chosen and limited territory, and controls were established for the single plane flights. These usually consisted of easily identified physical features or muslin markers placed on the ground. They were invariably selected or placed so that the pictures taken in one flight between them would cover the terrain to both sides of the established ground line. At the same time that this was being done, the ground parties indicated by controls the boundaries of those rugged and questionable areas that were to be covered by parallel plane flights. In these sections it was almost impossible, on account of the heavy growth, to establish markers that would sufficiently control single plane flights so that they would cover the line. And, when possible, this was not always thought advisable because there were usually in the area several alternate lines from which the proper line could be readily selected by the use of the pictures in combination with the work done by the ground forces.

The pictures resulting from the parallel flights were used to construct mosaics, upon which the final line was portrayed and from which such information was obtained as was thought necessary in making and supplementing maps.

It was decided to fly the planes at 15,000 ft., as pictures taken from this altitude would give all the detail desired. Bases for field operations were David, Panama; San Jose, Costa Rica; Managua, Nicaragua; and Guatemala City, Guatemala. Landings were made from time to time at other points. The planes belonged to the U. S. Air Corps, and were two-seater, single-engine Morse.

Two types of camera were used, the K-3 with a single lens, and the T-2 with multiple lenses. The type K-3, at the altitude flown, covers a strip two miles wide at sea level. It was used either where a single flight could be very definitely controlled by points on the ground reconnaissance line, or over areas where it was necessary to construct mosaics from the photographs taken during a number of parallel flights.

The type T-2 under the same conditions covers a strip nine miles wide at sea level. It was used either where the line of flight could be controlled by some such physical feature, as a road or a trail that had been used as a basis for the ground reconnaissance, or over more or less level terrain where several choices of location might exist. In these cases it was more desirable than the K-3 because its wider coverage allowed the selection of a final line that could deviate considerably from the flight controls without falling off the pictures.

The altitudes of terrain that came within the camera field varied from sea level to 11,000 ft., resulting in great differences of scale on mosaics and individual pictures. To determine the scales for the many photographs would have entailed a great amount of detailed ground work, which was not thought necessary.

Before, however, the pictures could be used for the purpose desired, it was essential that some reasonable scale adjustment be made. This was accomplished by selecting points of known geographical location between which the straight-line distance could be accurately figured. This same distance, as shown by the pictures after they were carefully joined and oriented, was measured and furnished the data necessary for determining the average scale of the photographs in that area. It is evident that this method gives the greatest inaccuracies of scale at the places of highest and lowest altitude. These, however, were not thought of sufficient import in a reconnaissance survey to warrant the expense of further adjustment.

A pantograph was used in reducing the information contained on the pictures to the scale of 1 in.=4,000 ft., which had been selected for the maps. The line having been located on the pictures, was transferred to the maps at the same time as were the physical featured that appeared on the pictures.

The method outlined above gave very satisfactory information and an accuracy entirely commensurate with the results desired. It shows without doubt the advantages of aerial work on reconnaissance surveys, but at the same time brings out the necessity for much preliminary ground work and investigation if economy is to be the watchword.

The pictures taken at 15,000 ft. showed ample detail except over thickly forested areas, where little could be expected. However, over such terrain they showed the streams and sufficient topography to be of great assistance to th ground parties. Some difficulty was experienced in making photographs daily, for clouds in the wet season and smoke in the dry season interfered and made visibility very poor. Clouds proved particularly troublesome in the valleys, and smoke appeared generally over the whole area at the time when the lands were being cleared for planting.

A profile of the line was made, but the elevations thereon are largely conjectural except at important control points where they were determind with reasonable accuracy by aneroid readings. The line as shown is purely a reconnoitered line, and no attempt was made to enter into the refinements of a location. Consequently no contour or topographic maps were prepared from the pictures. However, the stereoscope was used in examining the pictures wherever it was thought advantageous or necessary.

Comprehensive Traffic Survey Completed For California Highways

TRAFFIC COUNTS, an analysis of habits of travel on California highways and a comparison of traffic with expenditures on roads were the objectives of extensive field and office work that has been under way for a year and has employed 14,000 persons. This study and the resultant report, which comprises three volumes, were made possible through aid from PWA, SERA and numerous local organizations, all coordinated under the general direction of the California division of highways.

On typical days traffic counts were made at 2,560 stations throughout the state on all classes of roads. About half of these stations were outside of cities. The other half were within 51 cities, which represent 84 per cent of the urban population of the state. Residences of owners of 6,000,000 license-plate numbers were checked to determine the origin of traffic. Results of the field study were analyzed in connection with revenues and expenditures for roads and streets by state, county and municipal governments for the period of 1914 to 1933.

The following is taken from the report: California's total road and street mileage is 95,957, of which 13,605 miles are state highways, 65,130 miles are county roads and 17,222 miles are city streets other than those included in the state highway system. The high-grade and intermediate type of hard surfacing is distributed as follows: city streets, 11,427 miles; county streets, 11,116 miles; state highways, 8,984 miles. Thus, approximately one-third of the total road mileage in the state has a high or intermediate-type surface—that is, portland cement concrete, asphaltic concrete, oil mix or oil macadam pavements. Automobile registration for 1934 includes 1,712,000 passenger cars, 288,409 freight vehicles and 326,000 vehicles from other states. Depression decreased the registration of passenger cars but increased truck and trailer registration.

Total expenditures for vehicle regulation and for highway construction and maintenance in the period from 1914 to 1933 inclusive, as proportioned among the three governmental units, were:

	Amount	Per Cent
State	$384,000,000	30.4
Counties	457,000,000	36.9
Cities	414,000,000	32.7
	$1,265,000,000	100.0

Of the state's annual vehicle mileage (a vehicle-mile is defined as one vehicle traveling one mile) 55.6 per cent occurs within cities, and of the remaining 44.4 per cent the greater portion (about three-fourths) moves on the state highways.

Engineering in Foreign Countries

Accounts taken from the foreign-language periodicals of important activities in engineering research, design and construction being carried on beyond the United States

TO GIVE the readers of *Engineering News-Record* quick glimpses of engineering activities beyond the United States, these short abstracts of articles and papers published in languages other than English are presented monthly. In these abstracts no attempt is made at a compendium of foreign-language articles, but selection is made from articles that emphasize some procedure or invention in engineering practice that has general interest or usefulness.

Previous groups of these abstracts from foreign periodicals have been published in *Engineering News-Record* of Jan. 31, Feb. 21, March 28 and April 25, 1935.

A new high dam in France

The construction of a concrete-arch dam, rising 413 ft. above its foundation, has just been completed by a French power company "Société des Forces Motrices Bonne et Drac." This dam, known as the Sautet Dam, is described by P. Sezary in the January, 1935, issue of *Travaux*.

The Sautet Dam is located in the narrow canyon of the Drac River, about 40 miles southeast of Grenoble, in the French Alps. The canyon is only 25 to 50 ft. wide, but spreads out above the mid-height of the dam, resulting in a crest length of 262 ft., which is still not quite two-thirds of the maximum height of the dam.

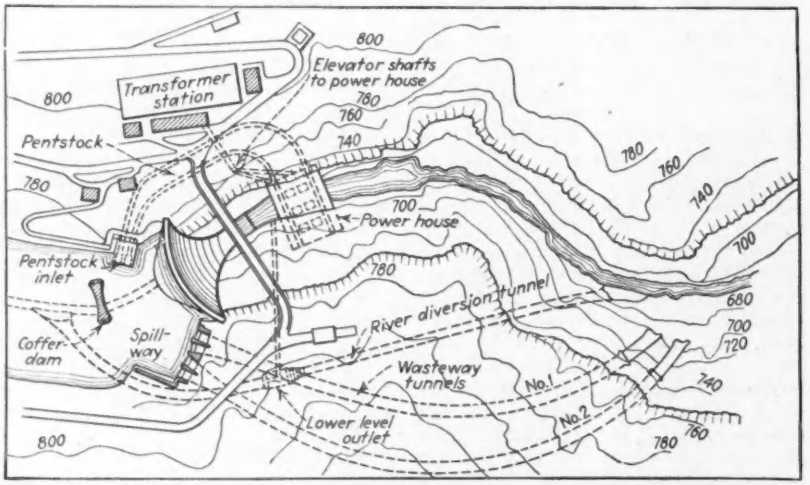
The walls of the canyon are of a Jurassic calcareous formation with numerous vertical planes of fracture. The peculiar topography and geology of the site necessitated considerable grouting and suggested the following design for the dam: (1) an effective so-called "active" arch, varying in thickness from 10 ft. at the crest to 56 ft. at the base, constructed of vibrated concrete containing from 368 to 460 lb. of portland cement per cubic yard; (2) a massive block of poorer concrete, most of it containing only 300 lb. of portland cement per cubic yard, which backs the "active" arch and is bracketed within the canyon walls, as shown by the horizontal section. With this block the over-all thickness of the dam varies from 246 ft. at the base (which is five to ten times the lower length of the dam) to a 10-ft. thickness at the crest.

At a level of 302 ft. below its crest the "active" dam is traversed by two circular outlets, 5.4 ft. in diameter, having a capacity of 2,825 cu.ft. per second, which discharge into a much larger culvert located in the body of the backing block of the dam.

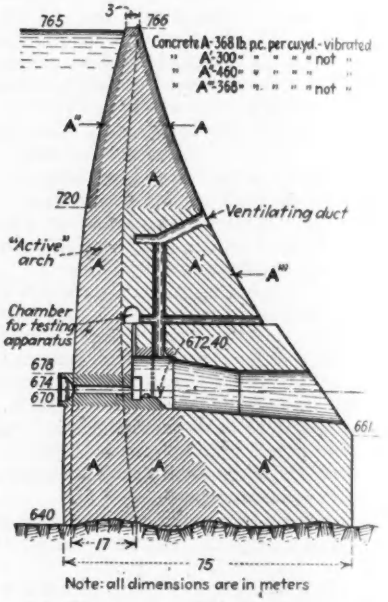
The total volume of concrete in the dam is 135,000 cu.yd.; the excavation amounted to 30,700 cu.yd. The concrete was of unusually dense and dry mix and had to be deposited with 2½-yd. buckets, in layers about 1 ft. thick, subsequently vibrated, where necessary, with compressed air "vibropils," weighing 175 to 220 lb., which operated at a pressure of 70 to 85 lb. per sq.in. The concrete is good for over 2,800 lb. per sq.in. while the average stress in the "active" arch is only 285 lb. per sq.in.

Two expansion joints, about 3.2 in. wide, commence at the crest and end about 150 ft. lower. The lateral surfaces of the gaps made by these joints are corrugated.

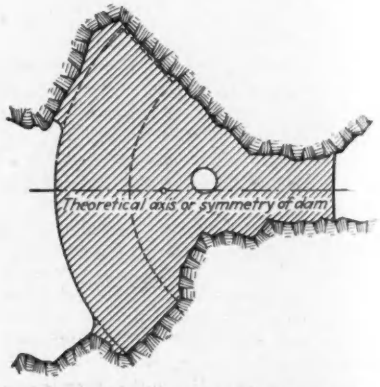
Many types of mechanical and electrical testing apparatus have been installed in the dam, most of it in a special chamber just back of the "active" arch near its mid-height; included is a Coyne deformeter, which utilizes the variation in the musical pitch of a metallic string vibrated by an electro-magnet to measure strains.



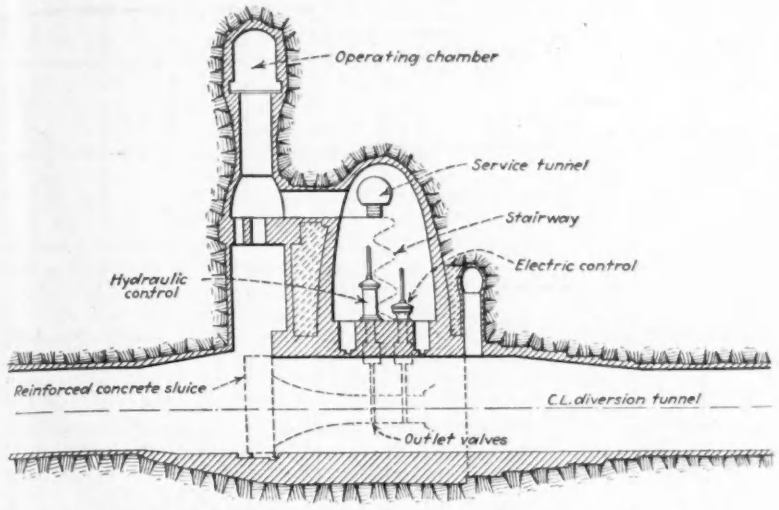
HIGHEST OF FRENCH DAMS crosses narrow rock gorge of the River Drac, requiring extensive tunneling for river diversion and spillway and a power house carried on an arch spanning the gorge.



SAUTET DAM, 413 ft. high across the River Drac in France, consists of a thin active arch and a supporting buttress arch.



HORIZONTAL SECTION of Sautet Dam, showing how active arch is keyed into the rock gorge by the buttress arch.



OPERATING CHAMBER for diversion and reservoir drainage tunnel at Sautet Dam.

The Drac at Sautet drains an area of 382 square miles, which has been known to yield a maximum of 74 cu.ft. per second per square mile. Yet the spillway of the reservoir was designed for an actual capacity of 56,500 cu.ft. per second, or 148 cu.ft. per second per square mile—which is twice the maximum flood observed.

The wasteways consist of two concrete-lined tunnels, 409 to 947 sq.ft. in cross-section, nearly 1,000 ft. long, discharging into the canyon at a height of 230 ft. above the riverbed.

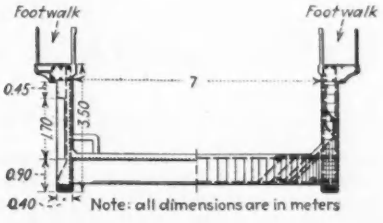
Another outlet is afforded by a concrete-lined tunnel, 19.7 ft. in diameter, 1,250 ft. long, used to divert the Drac during construction. Its capacity is 11,650 cu.ft. per second, which permits the reservoir to be entirely drained in nine to thirteen days, depending on the flow of the river. At about 500 ft. from its inlet this outlet is controlled by a system of sluices and valves, where the flow may be diverted into heavily reinforced pressure conduits that may act as scouring outlets.

The total capacity of the Sautet Reservoir is 105,000 acre-ft., of which only 80,000 acre-ft. are counted on for generation of power. The lower 25,000 acre-ft. of the volume of the reservoir is expected to silt up in the course of a hundred years or so.

The powerhouse, located at a rather inaccessible point 230 ft. downstream of the dam, straddles the river gorge by means of a concrete-arch foundation having a clear span of 120 ft. Admission to the power house is by a vertical shaft 13.1 ft. in diameter, 426 ft. deep. Two high-speed elevators are operated in this shaft.

A submergible highway bridge in Italy

An unusual reinforced-concrete bridge at Bomporto, Italy, whose roadway is below the high-water level of the stream it bridges, is described by Renzo Bertolani in the 1934 *Mémoires de l'Association Internationale des Ponts et Charpentes.*



CROSS-SECTION of Italian bridge designed to give passage to travel while high water is above floor level.

This bridge, which has a clear span of 79 ft., crosses a leveed section of the Naviglio Canal. A combination of local conditions dictated a certain level for the roadway that was 5 ft. or more below high-water level of the canal. The bridge is therefore designed as an impervious trough subjected to several feet of hydrostatic pressure on both sides, and has been reinforced according to these requirements, as shown by the accompanying cross-section.

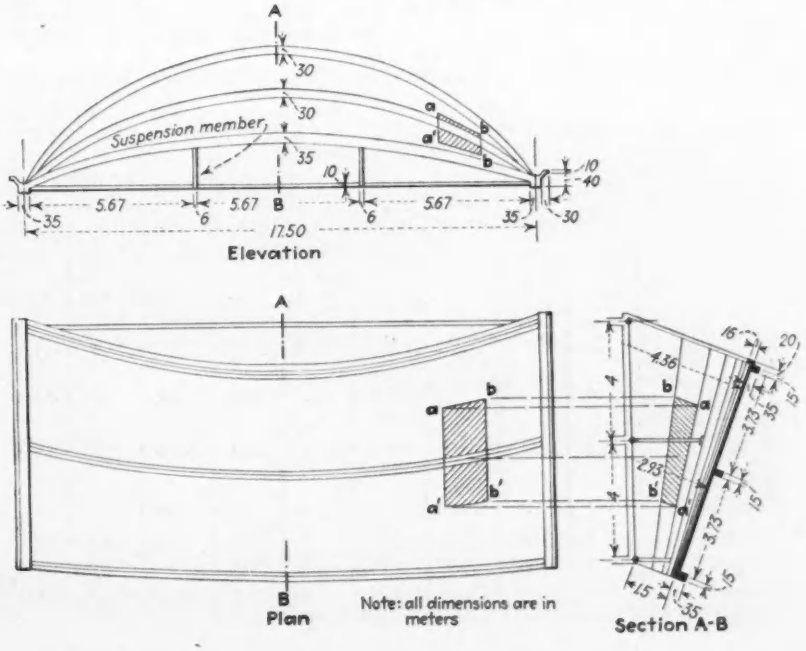
Tests of reinforced concrete conoid roof vault

In building the roof for its new Fontenay carbarns, the subway company (Compagnie du Metropolitaine) of Paris has adopted a design consisting of a double series of truncated conoid shells (28 of them all together) ranged one behind the other. This design was preferred to the more common cylindrical barrel vault system, patented by Zeiss-Dywidag of Germany, not so much on account of structural features as because it gave better daylight illumination of the interior. The crescent-shaped aperture at the junction of two vaults, where one telescopes into the other, is utilized to admit daylight.

These conoid shells have a uniform span of 57.4 ft., a rise of 14.3 ft. tapering to 4.9 ft., a length of 26.2 ft. and a thickness of only 2 in. The concrete is of rich mix, 1:2:2.8, with 8 per cent water. Each shell is reinforced with three arched ribs, 13.8x5.9 in. in cross-section, spaced 13.1 ft. apart, tied with a suspended bowstring rod. The steel reinforcement of the shell consists of ¼-in. bars about 8 in. apart, transversely, and about 4 in. apart, longitudinally.

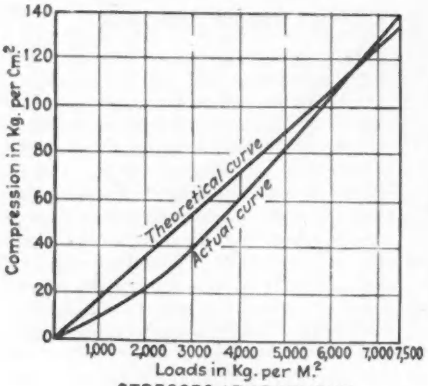
The design and full-scale tests of a conoid element of these dimensions were

ROOF VAULT of reinforced concrete for carbarns of Paris subway, showing location of the load for testing to destruction.

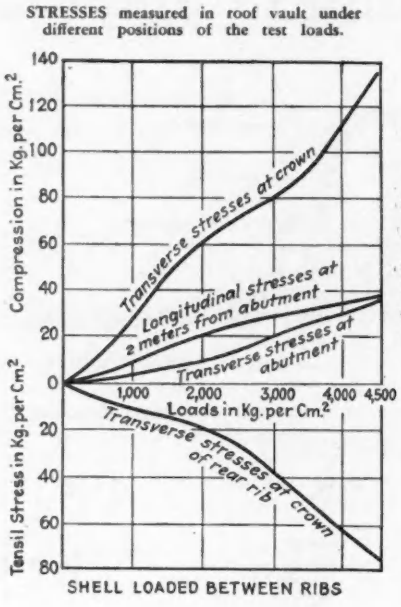


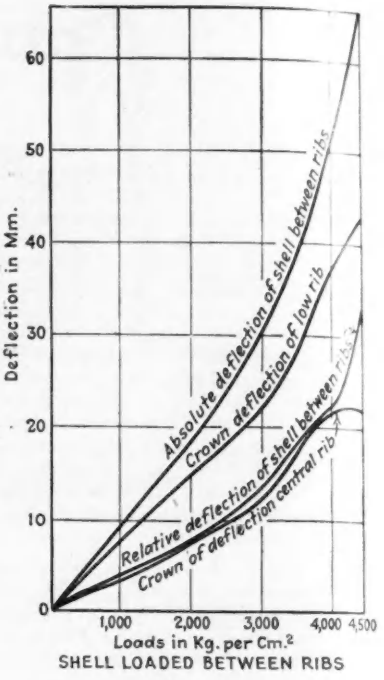
reported on by M. Fauconnier first in *Génie Civil* of June 10, 1933, in a preliminary form, and lately, in final form in the 1934 volume of *Mémoires, Association Internationale des Ponts et Charpentes.*

The tests, which confirmed the assumptions of the theoretical design, consisted of successive loadings of strips, 3.9 ft. wide, both over a central rib and midway between two ribs. The rib withstood a loading of 1,530 lb. per sq.ft., but the shell broke under a load of 1,175 lb. per sq.ft. The measured stresses and deflections are shown by the accompanying graphs.



STRESSES AT ABUTMENT
SHELL LOADED ALONG RIB


STRESSES measured in roof vault under different positions of the test loads.
Compression in Kg. per Cm.²
Transverse stresses at crown
Longitudinal stresses at 2 meters from abutment
Transverse stresses at abutment
Tensil Stress in Kg. per Cm.²
Transverse stresses at crown of rear rib
Loads in Kg. per Cm.²
SHELL LOADED BETWEEN RIBS


Deflection in Mm.
Absolute deflection of shell between ribs
Crown deflection of low rib
Relative deflection of shell between ribs
Crown of deflection central rib
Loads in Kg. per Cm.²
SHELL LOADED BETWEEN RIBS

The immediate cause of failure was due to excessive bending between ribs, though the stresses responsible for this did not exceed 14 per cent of the total load at the crown.

French tests of asbestos-cement concrete

Results of important tests of asbestos concrete have been published by R. Pascal in *La Téchnique des Travaux*, August, 1934.

The outstanding property of this concrete is its great tensile strength along the asbestos fibers, which permits its use in thin sections of 1 in. or even less without any steel reinforcement. Tests made by Bureau of Veritas indicated an ultimate tensile strength as high as 2,177 lb. per sq.in. Compression tests of three prisms, about 16x16x6 in., made at Conservatoire National des Arts et Métiers, indicated an ultimate strength ranging from about 4,740 to 5,002 lb. per sq.in.

The concrete mix was approximately in the proportion of 1:2.1:4.3. The plan of the tests is considered open to criticism, and the published data are incomplete; yet it appears there can be no doubt of the efficacy of the asbestos-cement encasing tube, particularly when combined with spiral-wire reinforcement.

Large-scale tests have also shown that corrugated curved elements of asbestos-cement concrete, only 0.8 in. (20 mm.) thick, can be used without any reinforcement or tierods, for the construction of barrel-vault roofs up to 65 ft. in span. Four such elements, 16.4 ft. long and 4.9 ft. wide, have been used to make a barrel arch with three laminated hinges.

VALUES OF ASBESTOS-CEMENT CASINGS FOR COLUMNS OF ORDINARY REINFORCED CONCRETE

Type of Column	FIRST SERIES Column diameter: 15.75 in. Column height: 29.5 in. Longitudinal reinforcement: six ½-in. round			SECOND SERIES Column diameter: 11.8 in. Column height: 29.5 in. Longitudinal reinforcement: six ½-in. round			THIRD SERIES Column diameter: 9.8 in. Column height: 29.5 in. Longitudinal reinforcement: six ⅜-in. round		
	Thickness of Asbestos Cement Casing, In.	Pitch of Spiral Reinforcement, In.	Ultimate Stress, Lb./In.	Thickness of Asbestos Cement Casing, In.	Pitch of Spiral Reinforcement, In.	Ultimate Stress, Lb./In.	Thickness of Asbestos Cement Casing, In.	Pitch of Spiral Reinforcement, In.	Ultimate Stress, Lb./In.
1. Control column, ordinary concrete, no casing	0	.....	2,347	0	.....	1,906	0	.....	2,332
2. Column encased, but no spiral reinforcement	0.4	.....	2,674	0.4	.....	2,702	0.28	.....	2,569
3. Column encased, with spiral-wire reinforcement	0.4	1.6	3,912	0.4	1.6	4,295	0.28	1.6	4,210
4. Same as 3	0.4	1.0	not reported	0.4	1.0	5,689	0.28	1.0	5,433
5. Same as 3	0.4	0.6	4,950	0.4	0.6	6,400	0.28	0.6	5,802
6. Same as 3	0.4	0.4	6,200*	0.4	0.4	7,112	0.28	0.4	8,421

* Beyond capacity of testing machine

Retarding reservoir in sewer takes peak runoff

In revamping the sewerage system of Holthausen, a suburb of Duesseldorf, Germany, it was found that a retarding reservoir near the center of the drainage area working in conjunction with three automatically operated pumping units would remedy insufficient capacity due to inadequate sewer sections and to backing up of the river at high water. This retarding reservoir, operating on the principle of a detention reservoir in a flood-control system, is described by Franz Schreier in *Gesundheits-Ingenieur*, Dec. 1, 1934.

The capacity of the reservoir was computed on the basis of a storm rainfall of a maxium observed intensity of 2.83 in. per hour, lasting 20 min., a runoff coefficient of 0.25, and an area of 110 acres, which is 50 per cent greater than the present contributing catchment surface. The actual normal capacity of the reservoir is about 103,000 cu.ft., which is 7 per cent in excess of the computed value. Add to this 50,000 cu.ft. for freeboard, and the total maximum storage capacity rises to 153,000 cu.ft., or 1,147,000 gal.

The reservoir is an underground, covered, reinforced-concrete structure not unlike a filtered-water reservoir of a waterworks system. It is located in a low-lying municipal athletic field, and its

roof will serve as the bottom of a wading pool. Its plan is rectangular, 180 by 82 ft. Its height is 9.8 ft. at the upper end and 11.7 ft. at the lower, due to the floor being sloped on a 1 per cent grade.

It was designed for two critical conditions: (1) reservoir empty, 6½ ft. head of groundwater pressing inwards; (2) reservoir full, groundwater below bottom. Roof, bottom and columns are designed as a mushroom system. The columns are spaced 18 ft. apart, longitudinally, and 21 ft. 2 in. apart, transversely; they are 18 to 25 in. thick. The bottom slag is 16 in. thick, the walls and the roof, carrying the weight of the water in the wading pool, are 10 in. thick. The roof is divided by one construction joint running transversely through its center. Blast-furnace slag cement was used in making the concrete, and the reinforcement is of high-grade twisted bar steel that is good for a working stress of 25,600 lb. per sq.in.

The bottom of the reservoir is lower than that of the inlet sewer. An open brick-lined channel, traversing the reservoir along its longitudinal center line, is of sufficient capacity to carry the ordinary dry-weather sewage; in rainy weather it overflows and floods the reservoir. The reservoir is emptied by means of an automatically operated pump, 2,380 gal. per minute in capacity, housed in a waterproof chamber built in with the reservoir. A special safety sluice protects the reservoir against backflow from the sewer downstream.

Articulated Block Revetment Replaces Upper Bank Slabs

Newest Mississippi River revetment practice continues underwater articulated-concrete-block mat construction to crest of river bank

IN UNDERTAKING the present plan of straightening the low-water channel of the Mississippi by systematically cutting off selected river loops (*ENR*, June 29, 1933, and Aug. 30, 1934) it was anticipated by the engineers that new points of bank scour would probably result from the change, and protection by revetment would be necessary. One of these operations at Leland Neck Cutoff is made particularly interesting: (1) because it shows the new practice of extending the underwater mat to the top of the upper bank; and (2) because it is designed to hold the cutoff channel in line with a future cutoff to be made farther upstream across Tarpley Neck (Fig. 2). The development of the Leland Neck Cutoff was described in *Engineering News-Record*, Sept. 21, 1933. Incidentally a revetment similar in type but much longer (7,600 ft.) was constructed last year at American Cutoff, about 15 miles below Leland Neck.

FIG. 1—SINKING articulated concrete mattress from mat boat 700 ft. from bank. Mooring barges at right are anchored upstream and permit mat barge to move directly across the stream away from the bank, paying out the mat as it proceeds.

As shown by Fig. 2, the Leland Neck Cutoff is located in the lower loop of the famous Greenville Bends, where in four successive bends the river takes 40 miles to go 10 miles toward the Gulf. It is 1.3 miles in length but eliminates 10 miles of river travel. The new channel, opened in June, 1934, now carries over 60 per cent of the low flow.

Maintenance of the banks of the cutoff and holding the channel on a predetermined line were a difficult task because the river makes almost a right-angle turn into the cutoff, with a resultant concentrated erosive attack on the left bank before the current is deflected. In consequence it was necessary to revet the left bank. A short stretch of concrete revetment, using riprap paving with a 100-ft. strip of flanking mat, was placed on this bank at the lower end of the cutoff late in 1933, but subsequent recession of the bank upstream from this protection brought about a decision to add 2,000 ft. of articulated revetment. This action was furthered by the desire to hold the channel along a predetermined line, in view of the proposed cutoff across Tarpley Neck immediately above the Leland Neck. This next cutoff will improve river alignment, eliminate 10 more river miles and direct the streamflow into Leland Neck Cutoff without curvature.

The sequence of operations on the project was bank clearing, bank grading, placement of subaqueous mat, upper-bank paving with articulated mattress, and tetrahedral-block flank protection. Bank grading was begun on Oct. 15, 1934, and required ten days to complete. A total of 311,000 cu.yd. of material was moved to dress the 40-ft. bank to a 1 on 5 slope. To provide a larger area at the ends of the revetment to resist flank attack, the last 100 ft. was graded to a 1-on-7 slope. The plant used for this operation consisted of a 100-ft. tower cableway bank grader

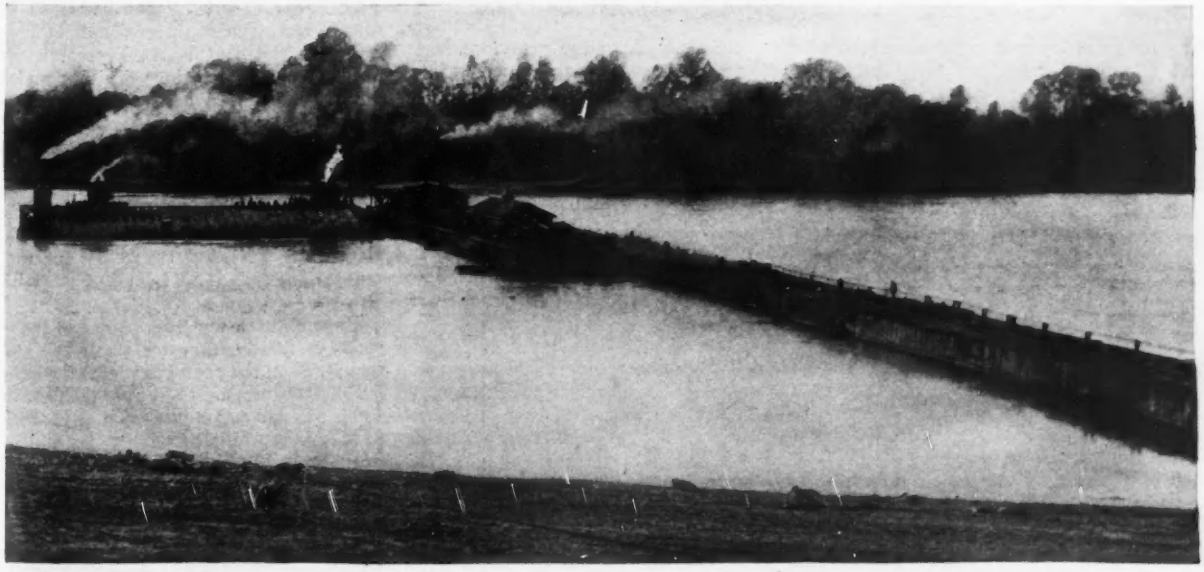


FIG. 2—GREENVILLE BENDS of the Mississippi River, showing completed cutoff at Leland Neck. Tarpley Neck is the next through which it is planned to cut.

FIG. 3—OVERLAP OF REVETMENT MATS on curves is reduced by the special slab arrangement shown.

with the head tower mounted on a barge and the tail tower walking along the top of the bank. A 12-yd. bottomless bucket was used. A 2-yd. dragline and two tractors with bulldozers handled the finishing. About 350 men were employed on grading and clearing, working three 8-hour shifts five days a week, and about 100 of the 350 men were used in clearing the upper bank.

The underwater mat was placed with the standard sinking plant (see *ENR*, March 15, 1928, p. 434, and Dec. 25, 1930, p. 996), consisting of upper and lower strings of mooring barges and a mat boat (Fig. 1). The latter is essentially a river anchorage for the launching cables of the mat and provides an assembly deck on which the individual squares (each a 100-sq.ft. section composed of twenty 15-in. by 4-ft. concrete blocks 3 in. thick) are fastened to the launching cables. By backing the mat boat outshore along the mooring-barge string, the completed mat is lowered into the river and brought to rest on the bottom. This plan placed 737,700 sq.ft. of mat from Nov. 1 to 10 inclusive, with 950 men working two 6-hour shifts.

The upper-bank paving was carried on simultaneously with the subaqueous work, followng closely behind that operation to make connection with the underwater mat and carry the protection continuously up to the top of the bank. The work was divided into two operations: spreading a 4-in. layer of gravel blanket over the entire bank area and placement of the concrete revetment on this blanket. The gravel base is placed to insure drainage for the rain runoff and the percolation from the bank itself, and to prevent scour at high stages. It helps prevent saturation and keeps the foundation stable. The crew of 150 men divided their time, working one 6-hour shift spreading gravel and two shifts laying the concrete mattress.

In placing the concrete squares, a dragline type of bank-grading machine transferred the squares from the mat barges to the bank. The machine is equipped with a 155-ft. boom and a traveling carriage that permits the spotting of the squares where required. Since the boom was not long enough to reach the top of the bank, squares were placed in position as far up as possible, and additional squares were snaked to their location by a line attached to a small tractor. To avoid dragging the squares over the gravel blanket, they were hauled upward on completed paving and then slid sideways into position. After the individual squares were in place, they were fastened to adjacent squares by wire ties twisted around the projecting metal fabric embedded in the blocks.

Care was exercised in placing the upper-bank mattress to compensate for the curvature of the bank (Fig. 3). This was accomplished with a minimum of lap by cutting short successive strips of squares and then squaring around to start on a new line normal to the water's edge. An average of 417 squares of bank was protected thus per day.

A strip 100 ft. wide at the end of the project was paved with concrete tetrahedral blocks of 12-in. altitude. They were placed to average about 250 blocks per 100 sq.ft. Those placed below water were simply thrown over the sides of the barges in which they were transported—calculating for drift. The blocks placed in the dry were handled by a cableway type of bank-grading machine, with a 3-yd. rock skip replacing the grader bucket. This operation was completed in two days, averaging 101,172 blocks placed per day.

This work of protecting the cutoff was carried out as a part of the regular revetment program of the Mississippi River Commission for the Lower Mississippi River. Major Lunsford E. Oliver is district engineer for the Vicksburg District, and W. L. Lipscomb has charge of the operations division under whose direction the work was performed. Immediate field supervision was under C. C. Phillips, area engineer. All work was by force-account.

Roadway Expenditures by Railways Increase in 1934

Expenditures by the principal railroads of this country for roadways and structures in the year 1934 totaled $120,707,000 as compared with $88,493,000 in 1933. Similar expenditures in 1932 were $130,823,000. Other capital expenditures in that year, however, were less, so that the total 1934 expenditures for railway equipment, roadway and structures of $212,712,000 were the highest since 1931, when $361,912,000 was spent.

Long Intercepting Sewer Built Through Bad Ground

Large reinforced-concrete pipe at Cumberland, Md., carried in canal bed on stone base over mud bottom retained by permanent sheeting—City eliminates obnoxious open sewer by building 10-mile interceptor

FIGHTING wet weather, mud, sloppy bottoms and sewage seepage, two contractors on the new Cumberland, Md., intercepting sewer are eliminating the obnoxious and unhealthful condition of a stagnant open sewer by building 10 miles of sewer lines serving all parts of the city. Situated at the head of the historic Chesapeake & Ohio Canal on the banks of the Potomac River, Cumberland for years has dumped its storm and sanitary sewage into Wills Creek and the canal. Though the canal has not been used for navigation for more than a decade, the locks have been maintained, restricting the flow and thereby retaining most of Cumberland's sewage in its front yard. This situation was bad enough in periods of plentiful water, but the low river flow of the past few years has cut down the dilution in the canal to a point where the canal became merely an open stagnant cesspool, creating intolerable conditions.

Last year Cumberland floated a sewer bond issue of $235,000, supplemented by a special improvement bond issue of $100,000 sold early this year, obtained a PWA grant of $120,000 and went to work to clean up the mess at its door. Incidentally, the $100,000 issue of 4 per cent improvement bonds sold for 107.85. The intercepting system picks up all of the sewage and carries it to a 30-acre tract that the city owns between the canal and the river. Some day, perhaps in the very near future, a treatment plant will be built on this tract, but for the present the interceptor discharges into a short open channel leading to the river.

As the town is sewered on a combined system of storm and sanitary flow, the intercepting system was designed to accommodate storm flows, with overflow chambers at strategic points to divert most of the stormwaters into the canal and creek before they reach the proposed disposal plant. Starting at the outlet end, the first 2,800 ft. of the new line is 54-in. reinforced-concrete pipe, following along the canal bank for some distance, then crossing the canal and a railroad track and running through streets and private property. The next 10,800 ft. is 48-in. reinforced-concrete pipe, 4,700 ft. of which lies in the canal bed, special joints being designed for this section. The 54-in. and 48-in. sections, plus 400 ft. of 36-in. concrete pipe, constitute Contract No. 1, let for $237,665.

From the upper end of the first contract section the interceptor divides, one branch running along the east side of Wills Creek, through the business section, another branch crossing the creek and following along the west bank, and still another branch taking off at the creek crossing and running along the north bank of the river. All of this work, consisting of short sections of 27-in. concrete pipe with the remainder of 8- to 24-in. vitrified tile, was awarded as Contract No. 2 for $147,024. Except for the creek crossing and several railroad crossings, most of Contract 2 is standard sewer construction. Most of the difficulties in this contract, outside of the special structures, are occasioned by building in narrow streets, especially through the business section. A map of the entire system is shown in Fig. 1.

The Wills Creek crossing will be a 30-in. cast-iron pipe built in open trench, with half the creek at a time being shut off by sheet-steel cofferdams. This crossing ties in directly with a tunnel section under three railroad tracks, complicated by the presence of a heavy stone retaining-wall holding the railroad embankment on the creek side.

Working in city streets

The contractor on Contract No. 2 is using to good advantage a gasoline crane with a narrow ¾-yd. clamshell. The pavement is broken open by hand, then the trench is excavated by clamshell to a depth of 6 ft., a procedure complicated by numerous gas and water lines crossing the street in all directions.

FIG. 1—NEW intercepting-sewer system for Cumberland, Md., will carry the sewage away from the city's front yard. The main trunk is 54- and 48-in. concrete pipe, fed by tile pipe branches.

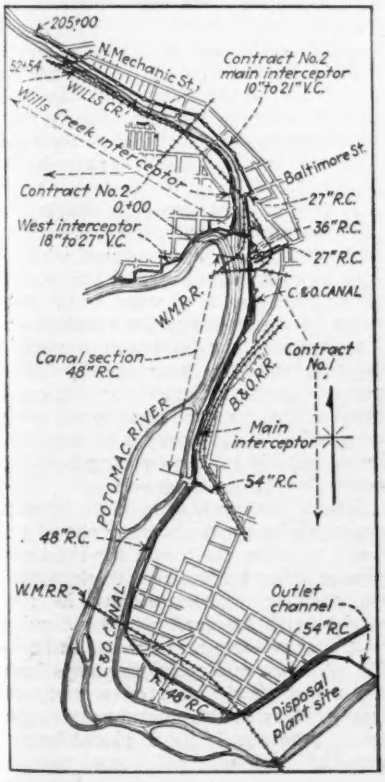


FIG. 2—EXCAVATION for a 48-in. section through the bed of the historic Chesapeake & Ohio Canal. The two cranes are working from the old towpath, the one in the background making a preliminary cut, while the near-by rig finishes the cut, lays the pipe and handles the backfill.

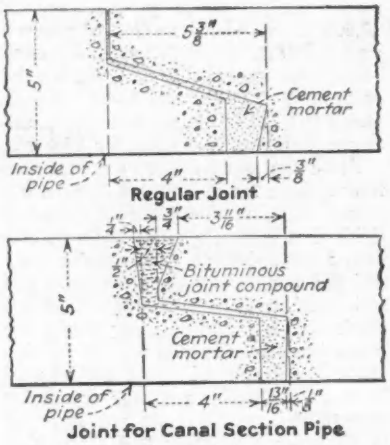


FIG. 3—SPECIAL concrete pipe joints with bituminous filler applied from the outside are designed to prevent infiltration through the canal section. The regular joint used elsewhere on the pipe line is shown at the top.

As fast as the material is excavated, it is transferred by truck some 500 ft. or so and dumped for backfill on the completed sewer. The backfill is shoveled from pavement to trench by hand for the first 4 ft. of cover, then it is dumped directly into the trench from the trucks. Most of the soil is wet, mixed with sand, gravel and small boulders, making a self-puddled backfill material of excellent quality. Following close behind the backfill crew are gangs of the water department and gas company renewing service lines, so the trench can be repaved at once by city forces.

Following the first clamshell cut, plank soldiers are set on both sides of the trench at 10-ft. intervals. These are carefully plumbed, held by jacks, and used as guides for wood sheeting, which immediately follows. This sheeting is braced by wales and cross-struts. By careful maneuvering the clamshell can work between the struts and carry the trench to grade with very little hand excavation required. As excavation progresses the sheeting is driven down by hand mauls. Wales and struts are removed as the trench is backfilled, but the sheeting is cut off just below pavement level and left in place as a protection to near-by conduits and a water main, as well as adjacent buildings.

The first step after the trench has reached grade is to install a 6-in. vitrified pipe, laid in a bed of crushed stone 16 in. square, as an underdrain (Fig. 6). The sewer pipe is laid directly on top of the stone, with the usual oakum and cement mortar joints. Backfill is continually carried close to end of pipe. Gasoline-driven diaphragm pumps keep the trench dry, though increasing underground flow has led the contractor to order a well-point system in hopes of reducing the amount of direct pumping and improving excavating conditions.

The most interesting, as well as difficult, work is the installation of the large concrete pipe on Contract No. 1. The 4,700-ft. stretch through the canal bed was especially difficult, being built during bad winter weather and it was here that the special foundation was required. Naturally, after years of dumping sewage into the canal, the bed was a soft slimy muck on top. This muck covered a denser formation resembling peat mixed with clay and containing a sprinkling of boulders. Rock bottom was found to exist from 3 to 12 ft. below invert level, the rock sloping transversely to the line of the pipe as much as 60 deg. with the horizontal.

It was desired to provide a foundation capable of carrying the heavy pipe (48 in.) without excavating to rock. The sloping ledge precluded any possibility of using pile supports. The first attempt at a foundation consisted of building an underdrain, encased in crushed stone, then laying a solid floor of 2-in. planking over the stone. The concrete pipe was set on the planking on a stone cushion retained by 6x6-in. longitudinal stringers. This scheme worked well until frost got into the soft material under the planking during a long cold spell, resulting in a highly disconcerting heaving and displacement of the pipe.

The next plan for a foundation, which proved successful, involved the driving to rock of two lines of wood sheeting 5 ft. apart, the top of the sheeting being carried 12 to 18 in. above invert level. This sheeting was driven after the trench, with wide sloping banks, had been excavated to invert level. After the sheeting was in place, the muck was removed from between sheeting lines for a depth of 30 in. and was replaced with crushed stone to subgrade (bottom of pipe). The concrete pipe was laid directly on this stone, the stone fill serving as an underdrain.

FIG. 4—WET WEATHER makes bad ground worse on a deep cut section of the 54-in. line. In the background is a preliminary cut made by a power shovel. Two gasoline cranes complete the cut and lay the pipe.

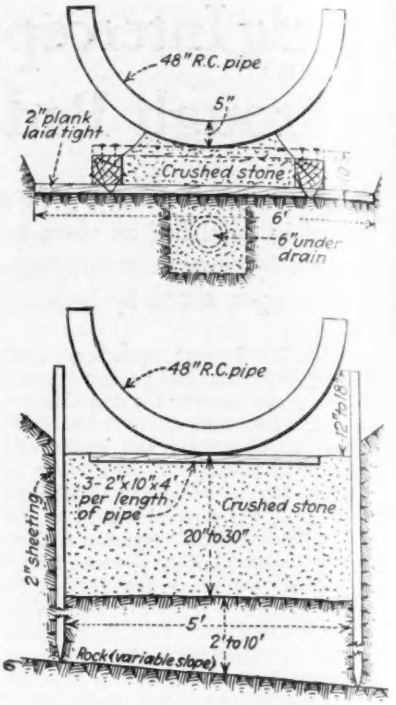


FIG. 5—SPECIAL FOUNDATIONS were required for the pipe through a stretch of soft ground in the canal bed, where muck overlies a sloping ledge. The top scheme was abandoned after frost got into the subgrade and heaved the pipe.

This scheme was later modified by reducing the depth of stone fill to 20 in. and setting the pipe on 2x10-in. sleepers 4 ft. long, three to a 5-ft. length of pipe. The sleepers distribute the load through the stone fill, removing the concentration at the center line of the pipe. The two types of foundations are shown in Fig. 5.

A special joint was provided in the pipe used in the canal section, to prevent infiltration. The pipe was built with an open locking joint (Fig. 3). The outside of the joint was filled with hot bitumen poured from on top inside a belt cover. The inside of the joint was previously pointed, and was later filled with a cement mortar. Except for the canal section, the concrete pipe joints were designed as locking, with a tight butt fit on the outside and a pointing groove for cement mortar on the inside.

Except for two long stretches in open country where a preliminary shovel cut could be made, the trench for the large pipe is being excavated with clamshells on gasoline cranes, usually in two stages, with the spoil stored alongside wherever possible for later use as backfill. Numerous diaphragm pumps keep the trench fairly dry, often pumping from perforated steel barrel sumps sunk below subgrade. Pipe is placed by the cranes.

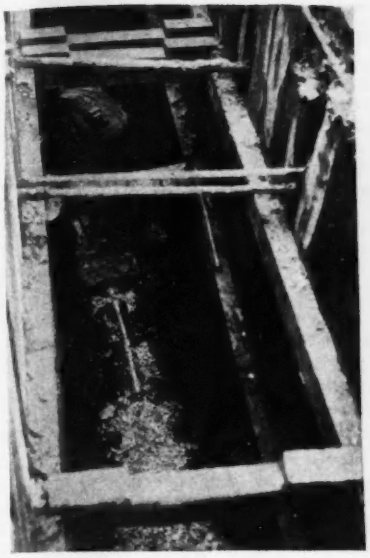


FIG. 6—PLACING a 6-in. subdrain on one of the 21-in. tile lines. The small pipes crossing the trench are water-service lines, and despite their presence and that of sheeting and bracing, a clamshell bucket was used for excavation.

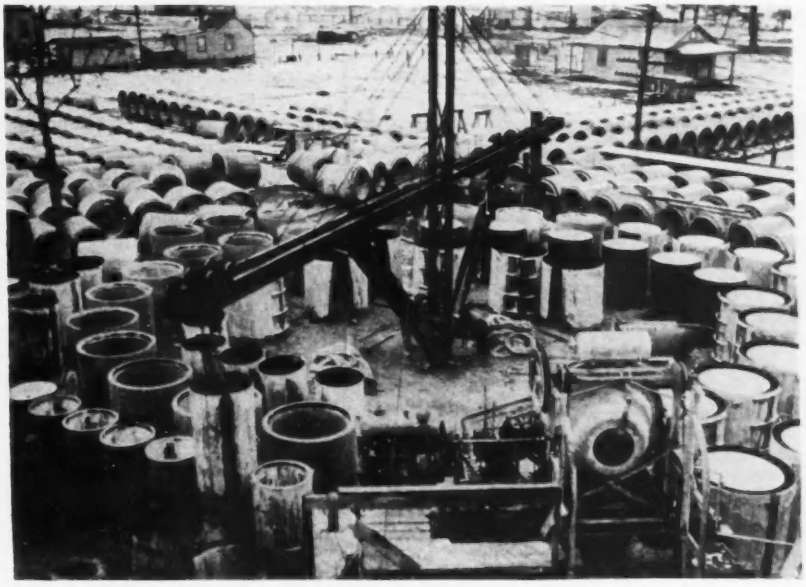


FIG. 7—PIPE CASTING YARD laid out in the concentric circles, served by an ungainly but highly effective merry-go-round crane operated by hand.

Besides the numerous manholes, there are many complicated junction chambers and other special appurtenances to build on both contracts. Because of labor restrictions, the contractors are experiencing difficulties in securing competent brick masons for this exacting work.

Pipe plant

All of the concrete pipe is being built on the job by subcontract at a novel open-air plant. The pipe contractor located his plant alongside a high railroad embankment where a side track on a trestle was available. Sand and stone are dumped directly from cars into storage bins at ground level. A ½-yd. concrete mixer is set on a high platform near the aggregate bins, charged by wheelbarrows and a vertical skip hoist.

The casting yard is laid out in two concentric circles, at the center of which is a home-made guy derrick with a counterbalanced full circle horizontal boom. This rig is known locally as a merry-go-around, which is an appropriate name. The boom carries a traveling hoist, both carriage and hoist lines being operated by hand winches set on the mast. This rig reaches the mixer and covers the complete casting yard. It handles all reinforcing, forms and concrete, the last in ½-yd. bottom-dump buckets (Fig. 7).

Reinforcing consists of two layers of wire mesh, cut and formed into circular cages by hand after mechanical forming had proved unsuccessful. Forms, both inner and outer, are split steel sections, readily collapsible. The locking joints are formed by steel rings. An old horizontal boiler furnishes steam through an underground piping system for 48 hours of steam curing under canvas. After curing, the pipes are stripped of forms and tipped over and rolled to a near-by storage yard. Delay in getting the pipe yard established necessitated a rush job on the first few pours. High-early-strength cement was used, resulting in concrete strengths of over 7,000 lb. in 28 days, and as high as 3,330 lb. in 5 days, with a 1:1½:3 mix. Later this same mix was used with standard cement, and a strength of 2,800 lb. has been obtained in three days.

Direction

Gannett, Eastman & Fleming, Harrisburg, Pa., were retained as consulting engineers to design the project and to supervise construction. Bernal H. Swab, as resident engineer, represents the consultants. Henry Schaidt, city engineer, represents the city, which furnishes the inspectors. Contract No. 1 is held by Robt. Lombardi, of Philadelphia, with E. M. Richardson as superintendent in charge. Seaboard Constructors, Inc., and Richards Kelley Co., Philadelphia, jointly have Contract No. 2. D. W. Whitmer is superintendent. The concrete pipe is being made by the Easterday Concrete Pipe Co.

FIG. 8—SPECIAL tapered sections of 54-in. concrete pipe make up into sweeping curves, as this section in deep cut near the outfall shows.

Quebec Proposes Public Ownership of Power

Bills have been introduced into the Legislative Assembly of the Province of Quebec relating to the development of water power and distribution of electricity in the province. The bills follow the presentation to the provincial government of the report of the Lapointe Commission on electricity in the province, and they open the way for public ownership of public utilities in the province, which, up to the present, has been a stronghold of private development.

One of the bills covers the creation of the Quebec Electricity Commission, to have full control over all power development and distribution in the province, as suggested in the commission's report. A second bill, of more direct interest to engineers, aims at giving the Quebec Streams Commission (the provincial hydrometric bureau which at present constructs storage works for river regulation), the authority to develop water power under government control, and to establish a system analogous to that of the Ontario Hydro Electric Power Commission, the purpose being to guarantee to municipal power systems a supply of power.

Handling 100,000 Men on Construction

An account of how construction jobs are used to reduce unemployment relief and add to a community's permanent wealth—Ten million dollars a month are expended by a single city through a highly developed management organization acting in cooperation with a hundred separate government agencies

UNKNOWN to most people, an engineering construction campaign of remarkable size and diversity of operations is in progress as part of the country's unemployment-relief activities. Current construction statistics do not include this work in their figures. It is not done by bidding and contracting methods but on a direct-management basis, and often the needed plans are prepared by emergency forces employed much like the squads of field workers.

A conception of the large scale of this construction enterprise may be obtained from the statement that in a single city, New York, it has kept no less than 100,000 men at work continuously for the past twelve months since the close of the federal CWA program. Direction of this force is a management job rivaling in complexity the greatest normal construction undertaking of the age. In addition to those difficulties that arise from the size and diversity of the work, it is complicated by the human problems of combining destitution relief with practical construction.

The average citizen who hears of relief construction is apt to think of it as haphazard work of no particular value. Is this true? Three questions are uppermost:

a. Is the work well organized, or is it handled in unsystematic, perfunctory manner; and if the former, what type of organization has been found adequate to handle so big a job?

b. Are the results useful and permanent, or are they ephemeral?

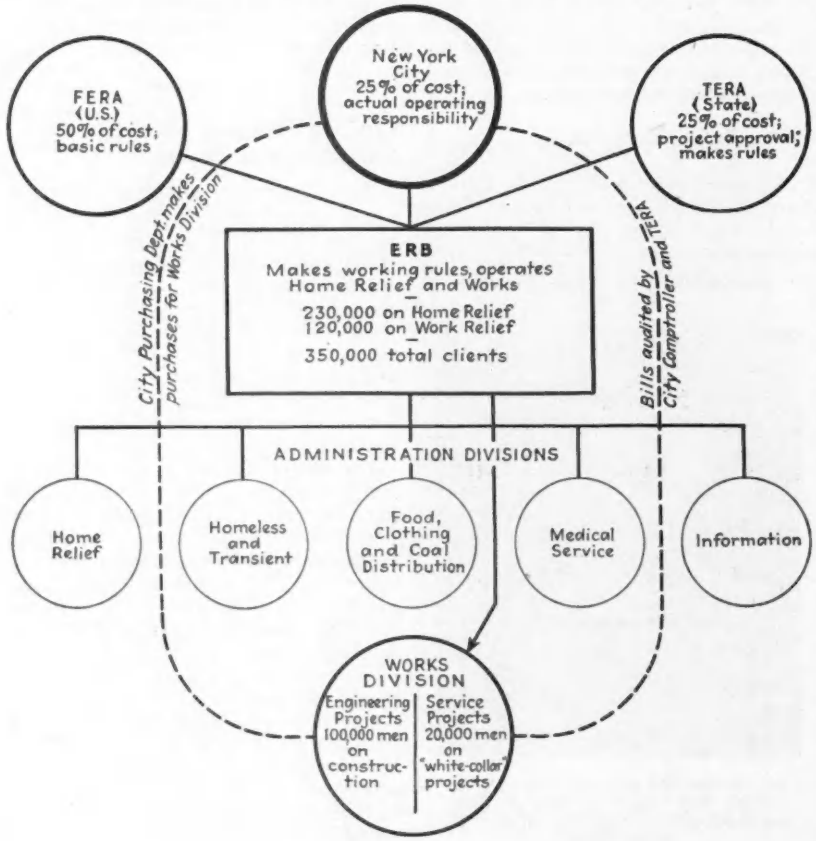
c. Is the job management in the hands of social workers, or are competent engineering managers in charge?

In briefest terms, the answers are, so far as New York's chief construction is concerned, that the work is organized in efficient, excellently functioning manner, that the construction work carried out is useful and permanent, representing a value of some forty to fifty million dollars per year, and that this is because management of the undertaking is in the hands of skilled engineers experienced in large construction operations.

By the very nature of the case a highly organized directing and administrative system is required for planning the work, employing and directing the working forces, and supervising performance and finances. The New York City organization, as reorganized during the past eight months under the leadership of Col. William J. Wilgus, former vice-president and chief engineer of the New York Central Railroad system and creator of the Grand Central Terminal, is operating smoothly and successfully, in spite of having to work in harmony with scores of separate bureaus of the city, state, and federal governments as the actual work-directing agencies as well as with several controlling and checking authorities that supply the money and require an accounting for its use.

In view of its successful operation the following factual account of how the organization makes use of construction jobs to reduce the number on the dole and increase the community's permanent wealth has been compiled, to place on record the general system of administration, as an example of unusually skillful engineering management. Its present interest is the greater because some of its inherent difficulties came to notice recently through the publicity created by an aldermanic inquiry into its working and results. Somewhat earlier, a more careful inquiry made by an expert committee appointed by the mayor emphasized the magnitude of the problem involved. The present article is based on current data.

FIG. 1—THREE MAIN AGENCIES control New York City's emergency construction, and the necessary coordination between them affects the methods of caring for 350,000 relief families, about one-third of whom are active on work-relief projects.


FERA (U.S.) 50% of cost; basic rules
New York City 25% of cost; actual operating responsibility
TERA (State) 25% of cost; project approval; makes rules
City Purchasing Dept. makes purchases for Works Division
ERB
Makes working rules, operates Home Relief and Works
230,000 on Home Relief
120,000 on Work Relief
350,000 total clients
Bills audited by — TERA City Comptroller and
ADMINISTRATION DIVISIONS
Home Relief
Homeless and Transient
Food, Clothing and Coal Distribution
Medical Service
Information
WORKS DIVISION
Engineering Projects 100,000 men on construction
Service Projects 20,000 men on "white-collar" projects

Relief and work-relief problems

Construction for work-relief is an integral part of the general unemployment-relief problem. According to figures of the Federal Emergency Relief Administration, 2,500,000 persons are occupied on work relief throughout the country. For New York City the figure at present is 120,000, of which number

80 per cent are engaged in engineering construction and 20 per cent in service and white-collar activities. This number of 120,000 compares with a total of 350,000 families on relief in the city. Far more are unemployed, however, the total number of "persons unemployed because of lack of work" in New York City in March being officially estimated by the mayor's committee at 870,000, living in 660,000 families, which means that only about half of the families with unemployed members have yet been reduced to applying for relief.

The relief percentage increased rapidly during the past year. From July, 1934, to February, 1935, the number of families on home and work relief in the city increased by nearly one-eighth, though unemployment remained about constant during that period. The fact that many are reaching the end of their resources is one of the most serious elements of the situation.

Early in the depression construction work was brought into use to take care of part of the relief roll, both to sustain and rebuild morale and to salvage part of the tremendous loss of production. Two years ago 30,000 to 40,000 persons were employed on work relief, as against about 100,000 who received home relief. But the problem continued to grow rapidly. The relief roll increased from some 100,000 families in 1932 to 350,000 families (embracing 1,313,000 individuals) today, and the yearly cost from less than $60,000,000 to about $200,000,000.

Organized first after the 1929 crash as a privately managed movement by the Prosser and later the Gibson committees, relief in New York City soon became too huge a problem for private direction, and in 1931 the state of New York provided money to help its local units do the job. In the latter part of 1933 all work-relief operations were taken over by the hurriedly established federal Civil Works Administration. On the termination of CWA operations four months later, the conduct of work relief was turned back to the city and state, but the federal government continued to supply most of the funds. At present half the total cost of both home relief and work relief is contributed by the federal government through the Federal Emergency Relief Administration (FERA), while state and city furnish each a quarter of the cost through special organizations.

Except during the short CWA period, the city's work-relief operations have for the past 1½ years employed from 100,000 to 150,000 workers continuously. The administrative methods have evolved with the growth of the relief problem, and are today of highly developed character.

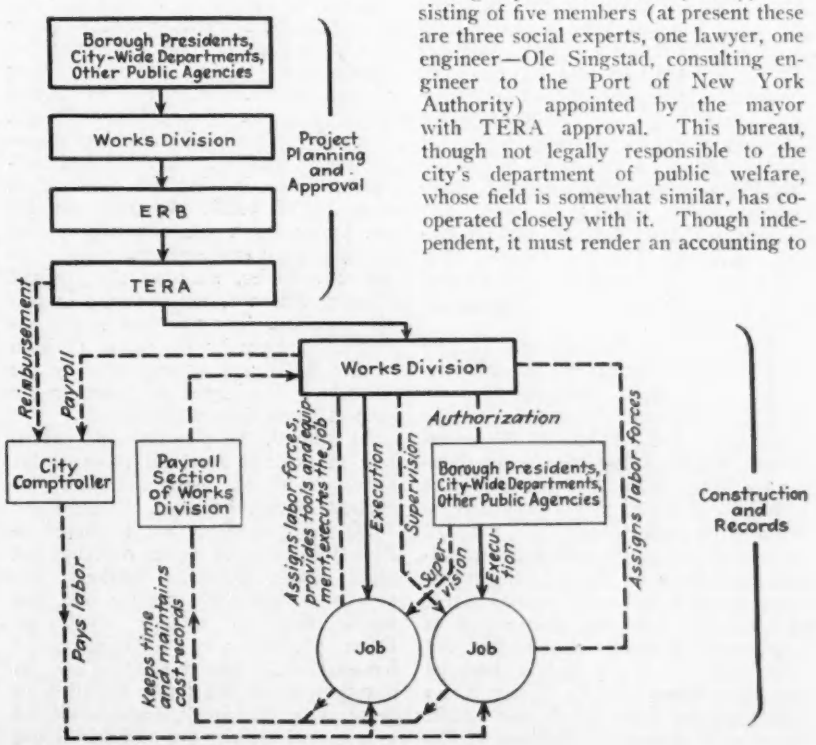
Construction utilized under difficulties

While most of the relief work is closely similar to normal construction, there are some important differences. It embraces a great many scattered jobs, many of them small, and covers a wide range of different types of construction. Workers of various kinds of individual skill are called for. The jobs are executed under numerous separate jurisdictions, these being the regular bureaus and departments with whom the work originates. The workers often are not qualified for the work to which they are assigned, and even where qualified they must be tried out as to their particular degree of skill. Discipline, transfer and discharge are restricted. Monthly working time is limited, to the extent that several shifts working in alternation are usually required. These conditions, all of which differ from those prevailing in normal construction, influence both the handling of the work and its rate of progress.

Additional requirements are imposed by the fact that since funds for the work (Fig. 1) come from three different sources (federal, state and city governments), there is threefold control and accounting. The choice of projects also is restricted by the rules necessary to distinguish relief work from normal or budgetary operations of the city bureaus. In order that there may be no reduction of the funds actually applied to relief the expenditure of money for material, tools and machinery is subject to limitations. Finally, consistent planning of the work is not always possible because the relief-work funds are allocated month by month, and therefore a continuing operation cannot be planned far into the future.

It happens that, with so large a reservoir of unemployment as that represented by the New York City relief rolls, every type of skill required in construction is available. Masons, carpenters, welders, rock drillers and blasters, steamfitters and other craftsmen are on the roll, and the qualified workers soon develop satisfactory skill and efficiency in their work.

FIG. 2—PLANNING as well as field execution of projects are checked and double-checked by cooperation of the city construction agencies, the Emergency Relief Bureau of the city, and the Temporary Emergency Relief Administration of the state.



General administrative system

Broad rules for the application of work-relief funds have been laid down by FERA as a condition governing the use of the relief funds that it contributes. The state Temporary Emergency Relief Administration (TERA), under Robert W. Boyd as district director for the New York City area, is responsible to the FERA for the proper application of these funds, and separately responsible to the state for proper use of the state's contribution. It is the agency to which the city relief organization must make its accounting. The regulations of the TERA are the prime working rules controlling the construction enterprise. They affect both selection and execution of projects and the handling of labor.

The city government in turn administers the work through a special organization created for the purpose, the Emergency Relief Bureau (ERB), consisting of five members (at present these are three social experts, one lawyer, one engineer—Ole Singstad, consulting engineer to the Port of New York Authority) appointed by the mayor with TERA approval. This bureau, though not legally responsible to the city's department of public welfare, whose field is somewhat similar, has cooperated closely with it. Though independent, it must render an accounting to

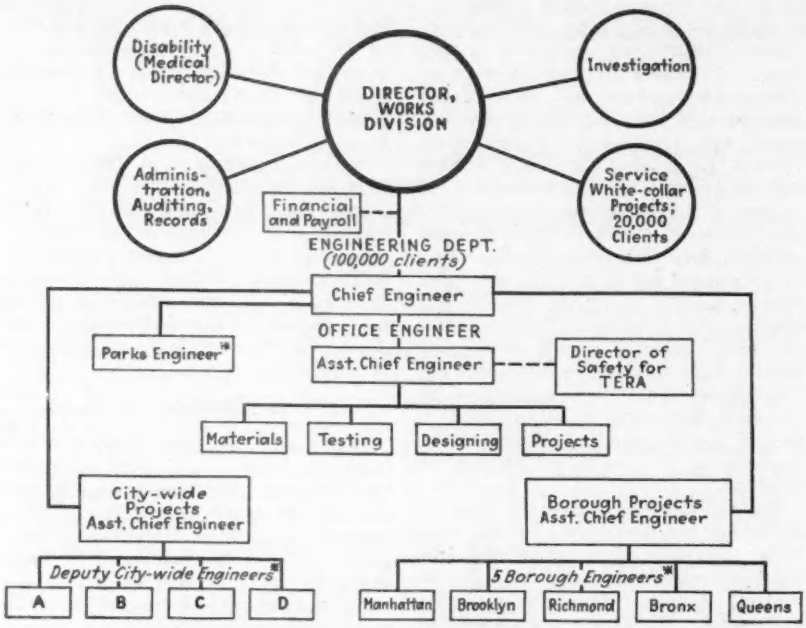


FIG. 3—PROJECT and employment control of the 100,000 men on engineering work-relief projects require a large and thoroughly articulated central organization embracing some 2,000 individuals. This is exclusive of a large organization engaged in home relief and transient relief, which maintains several dozen district stations throughout the city.

the city comptroller as guardian of the city's contributed funds. Purchasing is done for it by the city purchasing agent.

To these responsibilities to independent control authorities must be added the daily working relation of the ERB with a large number of city, state and federal bureaus who originate the work projects. There are 110 such bureaus—the five borough presidents (who are virtually directors of public works for their respective boroughs); 29 city departments such as parks, hospitals, sanitation, water supply; 25 other city agencies, 30 state agencies and 21 federal agencies. The list includes such bodies as the library board, the board of higher education, and the Museum of Natural History.

Were all the demands and project proposals of these various agencies accepted by the ERB, there would probably be enough work to absorb not only the entire relief roll but all the unemployed. On the other hand, many thousands of present civil service employees would be thrown out of work and be replaced by relief forces. To forestall this undesired result and prevent putting local costs on the federal government, the first and most important rule of work relief is that no project of "budgetary" character may be included (this rule was established in 1931 by the State Works Act). Under it, no work may be done which lies within the normal operating functions of the respective agency or work for which funds are available from the regular budget or might fairly be expected to become available. Another rule, only second in importance, is that all work done must be of useful character, either producing some new construction (building a retaining wall or extending a sewer outlet), or improving an existing property (painting a public building), or making a study of public importance (a traffic survey). A third and self-evident rule is that all work done must be of public character, carried out by or for a public agency within its recognized range of functions; semi-public agencies, such as the Natural History Museum, are included in this classification. The approval of any individual project by the works division of the ERB and subsequently by the TERA is contingent on whether the project meets these requirements.

In general, the planning and execution of projects meet all three of the above conditions. Many individual exceptions occur, however. Thus, about 3,000 relief workers are employed in the city hospitals as nurses, orderlies and other semi-professional workers, obviously a budgetary service and one which displaces regular employees. Other projects are borderline cases; for example, extensive clipping and indexing work in the public libraries, in progress as relief work, might be viewed as a normal activity but probably would not be included in budget appropriations for some years to come.

Planning the work

Most projects originate with one of the 110 agencies already mentioned; projects generally are not devised or created by the Emergency Relief Bureau itself. Not only do these agencies propose and plan projects but in most instances they also carry them out, the ERB's works division acting merely as labor-assigning, material ordering and controlling, financing and supervisory authority. However, where the agency in question is not equipped to direct the construction itself, the works division of the ERB executes the work and the regular agency supervises it. To state this simply, in most cases the regular agency acts as contractor and the works division as owner, while in some special cases the works division acts as contractor and the regular agency as owner. The former occurs, for example, in a sewer or paving job of one of the borough presidents, or in a building reconstruction or landscaping job of the Park Department; the other case is illustrated by a grading job on the grounds of the Board of Higher Education, which board has no organization or equipment for handling construction work.

As to type of work, almost every variety of construction operation is included in the program: laying water pipes for the department of water supply; demolishing condemned buildings for the tenement house department; painting various public buildings; building interior walls and partitions and erecting new buildings; constructing tennis courts, playgrounds, golf greens and recreation buildings in parks; clearing brooks and water courses; building and extending sewers, and cleaning sewers; removing abandoned street-car tracks; resurfacing and repaving streets and roads; remodeling heating plants; constructing outdoor market platforms; repairing beach bulkheads and boardwalks. A few examples are sketched in Fig. 4, and some field views are reproduced in Fig. 5.

In addition to construction projects there are also "white-collar" projects, which range over an even wider field, from housing studies to map-making and the construction of models. These are handled by the service department of the works division, whose operations (300 projects, 20,000 workers) are not dealt with in this article.

The largest employers of relief labor under the works division are the five borough presidents, with from 3,000 to 6,000 relief workers each, and the department of parks, with about 30,000. A number of other employers, however, utilize substantial relief forces: some 2,000 each in the Board of Education, the Department of Hospitals, the Department of Health, the Department of Water

Supply and the Department of Public Welfare; more than 1,000 each in the employ of the City Housing Authority, demolition work, improvement of the city's airport (Floyd Bennett Field), the Department of Docks, the Department of Markets, and the Department of Plant and Structures.

Operating organization

Before describing the methods by which men are put to work, directed and supervised, it is necessary to sketch the system of organization developed for the purpose, centering in the works division of the ERB. The relations of this main group to its superior authorities are indicated diagrammatically in Fig. 1, which shows the Emergency Relief Bureau drawing its funds from and responsible to three sources of authority, and in turn directing (through an executive director) the works division as well as other divisions concerned with home relief, transient relief, commodity distribution, etc. The works division, with its 120,000 clients, employs 100,000 men on construction and 20,000 in white-collar projects and service activities.

The type of organization created within the works division itself is outlined in highly condensed form by the diagrams in Fig. 3. The works division operates under Francis Boardman as director (Mr. Boardman having recently succeeded Colonel Wilgus, resigned) and John P. H. Perry as deputy director. Its operating section for construction projects is the engineering department (under J. W. F. Bennett, assistant director and chief engineer), organized in four groups, one for borough projects (Percy Litchfield, assistant chief engineer), one for city-wide projects (Harry P. Moran, assistant chief engineer), one for office operations (Carroll Blake, assistant chief engineer), and one for park work (T. V. Sauvlet, parks engineer). The borough and city-wide groups, each with a number of field offices, either execute or supervise the actual field construction work. The office organization specifies, requisitions and inspects material, conducts tests, prepares designs, estimates and analyses, and keeps cost records.

Complex as this organization may seem, with its more than 2,000 staff employees, it has proved excellently adapted to the service for which it was designed, and can by no means be considered too elaborate. On the contrary it has proved to be not large enough for the complete service that its directing heads would like to see it render.

How men are put to work

After the planning and approval of a project the executing agency when ready to employ the working forces makes requisition on the works division for the number and grades of men needed. The works division in turn requisitions the home relief division of the ERB, which keeps the relief-roll records and rather sketchily attempts to classify the individuals on the roll. From its relief lists the home relief division assigns the requisitioned number of men to the works division, and the latter after vocationally classifying them sends them to the jobs and enters them on the payroll.

Home relief also is charged with determining the eligibility of the individuals on its list, either before or after assignment to a job. This eligibility is subject to different criteria according to the grade of work involved. Anyone to get a work-relief job must establish need before he becomes eligible, and then is assigned sufficient work at the determined hourly wage to meet his budget, up to $25 per week. In the grades of employment with allowable earnings from $25 to $35 the needs test is still applied but wages are allowed in excess of the deficiency in the family budget. In executive positions, positions as foremen, etc., where full-time work is required to get the job done, employees are on a "non-relief" basis and do not have to pass a needs test, regardless of compensation. But the fact is that about 75 per cent of such "non-relief" employees in this organization were taken from the relief rolls and would be in need of relief if it were not for these jobs.

Per diem rates of pay are fixed by the city comptroller's determination of prevailing wage rates. The monthly earnings of the different classes of labor being fixed by the rules of the ERB, this wage determination limits the number of days per month that a given employee may work. According to his wage rate, the monthly working time of the individual worker may range from five days to two weeks. The practical result is that on a given job different groups of workers are arranged in different shift schedules. Thus, on a particular stone-faced concrete retaining-wall job now going on, the masons, carpenters, and the mixer operator work one week a month, so that there are four shifts of skilled workers in the month, while laborers work two weeks, and come on in two shifts per month. Supervisory employees (those on a weekly payroll, such as foremen) are not thus limited. Much of the supervision, however, is by employees paid by regular city departments. Average weekly earnings of works division employees are $16 ("relief" or job workers $14, "non-relief" or administrative workers $24.50.)

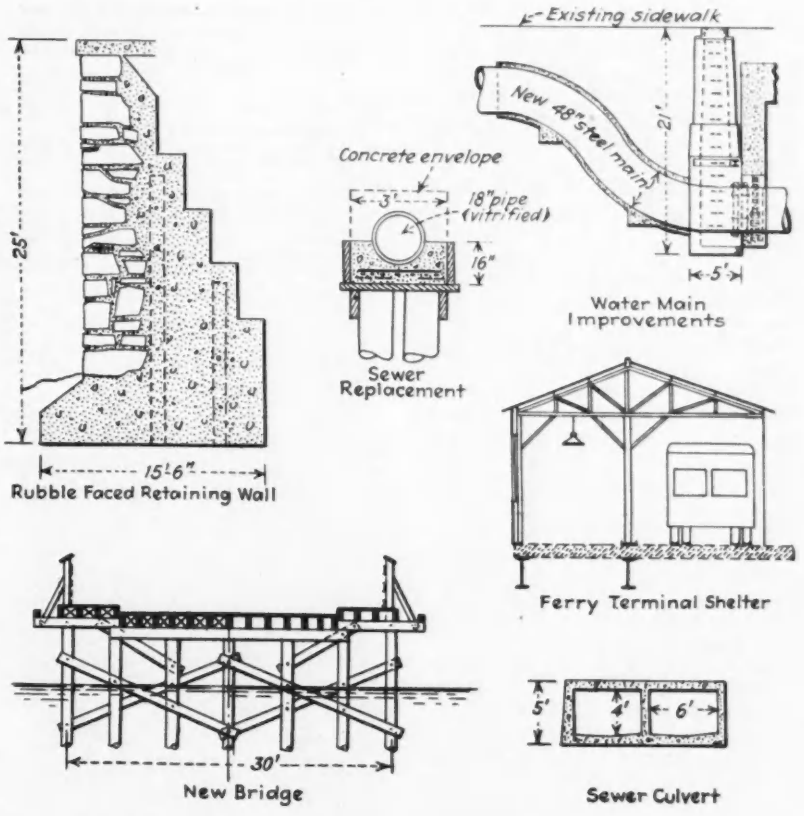


FIG. 4—ESSENTIAL IMPROVEMENTS of typical engineering character, illustrated by a few representative sketches above, form the main part of the operations of the works division of the Emergency Relief Bureau.

The home relief division of the ERB in filling requisitions for workers sent to it by the works division has, because of the gigantic case load (some 230,000 people on relief rolls), been unable as yet to perfect its vocational analysis of clients (relief beneficiaries), so that the home relief division in filling works division requisitions relies practically entirely on the client's own statement as to his vocational capacity. This has made it necessary for works division to set up a strongly organized personnel department, one of whose primary functions is to analyze vocationally all workers sent to works division by home relief. When home relief sends a worker to fill a requisition he is examined by the personnel department of works division and is not accepted until in the judgment of the personnel department he is a suitable individual to meet the requirements of the given requisition. If he is unsuitable he is returned to home relief or may be reclassified and used to fill a different kind of a requisition for which he is more obviously suited.

The personnel department of works division also renders a service of major importance in its re-rating and reclassification work. Any worker on works division payrolls may apply, through clearly defined channels and without interference by anyone, for a re-rating. For example, a home relief client who has been put on works division rolls as a laborer may previously have been an engineer or an architect or sculptor. If he can prove his fitness for such duties the personnel department, after a rigid examination by experienced examiners, re-rates him and his name goes into a so-called pool from which pool all requisitions are filled before works division applies to home relief for new workers.

One of the difficulties of orderly and efficient management of works division is the almost insignificant differential between what a given individual receives if he is on home relief (the dole) and what he receives as a *per diem* worker on works division. The average home relief payment to a family of 5 is only $2.00 or $3.00 below the average monthly earnings of the *per diem* worker. Of course, the worker on works division may work only from 5 days to 2 weeks a month to earn his wages. Nevertheless, it is stated that the disciplinary effect of firing a worker from works division activities and sending him back to home relief is nullified by the smallness of the differential.

In general, the policy of works division is humane and liberal rather than one of hardboiled construction efficiency. If a man is found inefficient or even lazy he is transferred from one project to another to give him another chance. But usually after three such transfers he is returned to home relief.

Material and equipment are supplied in most cases by the works division,

CONSTRUCTION COMPLETED BY WORK-RELIEF FORCES OF NEW YORK CITY—APRIL 1 TO DECEMBER 31, 1934

Item	Unit	Total
Sewers	lin.ft.	156,119
Brooks and water courses cleared	lin.ft.	507,683
Sewers cleaned	lin.ft.	26,403
Highways		
New wings and wearing surfaces on dirt roads	miles	168.6
Repaving	sq.yd.	2,103,739
Resurfacing	sq.yd.	792,695
Car-track removal	miles s. trk.	28.4
Resurfacing dirt roads	sq.yd.	1,202,590
Parks		
Golf greens	no.	84
Tennis courts	no.	80
Playground	no.	40
Park reservations	no.	21
Park buildings Floor area	sq.ft.	86,543
Public Buildings and Offices		
Floor space of new buildings	sq.ft.	51,660
Painting	sq.ft.	13,780,582
Partitions and walls built	sq.ft.	235,905
Dept. of Water Supply		
Water pipe laid	lin.ft.	191,734
Tenement House Dept.		
Buildings demolished	no.	297
Federal Forts Remodeled	no.	5
Materials		
Aggregate—sand, gravel, etc.	cu.yd.	183,041
Cement	bags	395,403
Coal	tons	1,839
Bituminous materials	gal.	1,534,329
Common brick	no.	14,605,000
Magnesia block, tile, etc.	sq.ft.	399,090
Lumber	ft. b.m.	12,709,599
Paint	gal.	125,528
Putty	lb.	17,348
White and red lead	lb.	194,805

though in a few cases the bureaus for whom the work is done supply materials and equipment, depending on the funds available and the character of the work. For those jobs that are executed by the works division itself, materials yards are maintained at different points in the city, and material is requisitioned from these yards by the engineer or superintendent in charge of the job.

Purchase of material is handled by the city purchasing department, and the same department also contracts for the hire of equipment. Most equipment is hired with operator; this applies to machines such as rock drills and compressors, shovels or cranes, and to trucks.

The fact that the department of purchase of the city is responsible for all purchases of materials and equipment or rental of equipment has been the source of infinite trouble to the works division and has furnished a basis for much of the criticism of works division operations. From a management point of view the handling of construction work without any control over materials and equipment is almost unthinkable in commercial life, but this is exactly the situation which has confronted works division since the early spring of 1934. Works division, or the sponsor of the project which it is carrying out, requisitions materials and equipment and passes these requisitions to the commissioner of purchase of the city; contracting for these supplies, expediting their delivery and seeing to it that the delivered items agree with the specifications, is entirely outside of the control of works division. Intolerable delays have occurred, and under the city purchasing law it has been impossible to insist upon materials meeting specifications until after the contract award has been made to the low bidder and the bidder has delivered unsuitable materials, in which case the unsuitable materials can be rejected and the whole procedure gone through again and new bids taken. Work relief would be of obviously higher efficiency if it included direct control over purchasing, delivery and inspection.

Many jobs have, in addition to relief workers and the "non-relief" men drawn from relief rolls, also a number of regular employees of the executing bureau, in supervisory positions. However, these are very few; in fact, the total percentage of non-relief workers is small, generally ranging from 2 to 8 per cent.

Supervision and control

Technical direction of field operations is completely separated from time and payroll supervision. All timekeeping and payroll supervision is under the authority of the payroll division. The timekeepers, field payroll supervisors, inspectors, etc., report direct to the chief of the payroll division. To be sure, this executive reports to the assistant director and chief engineer in charge of all construction operations. The control is similar to the line and staff functions of the United States Army. The timekeepers and payroll supervisors receive instructions as to their technique and their policies from the payroll department. They are responsible, however, for their daily operations to job superintendents or the field executives.

The actual writing of checks and paying of men is an entirely separate function from works division and is handled by the city comptroller through a deputy located at works division headquarters. This department of the city comptroller's office is largely manned at its top by civil service employees.

In the medical disability department of works division a similar situation exists in that the assistant director in charge of this department, responsible for all medical aid and care, reports directly to the director, but receives his technical policy instructions from the chief medical officer of the ERB.

Daily job reports returned by each individual job to the central office furnish a basis for close supervision of progress, personnel and costs. These reports are worked up for use in (1) the job cost records and (2) daily summary sheets covering the full scope of the works division operations and showing on one sheet the appropriations and the expenditure to date for each job then going on. Careful development of this reporting system has made it pos-

sible to have on the director's desk at noon each day a summary sheet covering all operations of the works division up to the close of the previous day. Through this sheet he is enabled to follow the workings of the operations under his charge throughout the full three-hundred-odd square miles of the city's area, and to know day by day whether he is running ahead of his appropriation either for an individual project or for the works division as a whole.

Cost records are important for proper control, but their function is by no means that of cost records in normal construction. All the principal officials of the Emergency Relief Bureau are constantly in mind of the fact that their primary responsibility is to provide relief, and that an accomplished piece of construction, while most important, is not a primary objective. While therefore they watch costs and attempt to keep them down by maintaining the highest level of efficiency reasonably to be expected under the circumstances, they are careful not to allow the seeking for efficiency to conflict with the primary need for extending relief.

Is the work efficient?

While the relief administration regards work relief primarily as a means of providing suitable wage-earning occupations for as many of its relief clients as the available funds permit, and considers the creation of useful construction results secondary, the works division has made an effort to reverse the emphasis. In Colonel Wilgus' words, "Self-respecting people get joy from the doing of worth-while things in an efficient manner, and in so doing give the taxpayer more for his money." This effort has not been without criticism from higher authority, however.

The threefold control of works division operations also hampers most efficient progress, and one of Colonel Wilgus' principal recommendations on leaving the post of director was that subject to defined policies and rules the works division be left as free to function as a private organization. This he declared to be the only way to obtain maximum efficiency in the public interest.

Inevitably, therefore, the efficiencies attained in these work-relief operations are less than 100 per cent. Data for precise estimation of the efficiency actually attained are not easily found, but experienced engineers and contractors on the staff of the works division are of the opinion that different operations attain efficiencies ranging from 20 per cent to 80 per cent or more; a general average efficiency of about 50 per cent is believed to be obtained. On individual jobs of reasonable difficulty the visible rate of progress and production and the cost figures suggest that results are obtained nearly equal to those to be expected under contract conditions.

In respect to efficiency, naturally much depends on the superintendent or foreman of the job, and his skill in handling men. Two other factors bearing on efficiency are frequent shifting or discharge of workers on the ground of relief ineligibility discovered after their assignment to a job, and the necessarily low rate of relief-work pay, which in a good many cases kills incentive. Such effects are unavoidable in combined relief and construction.

A year's accomplishment

Construction operations under the works division of the ERB at present reach a volume of nearly $100,000,000 per year. Current expenditures of the division approach $10,000,000 per month. Out of this about 20 per cent goes for service and white-collar operations, the remainder for construction. The value of the construction work accomplished is not readily estimated in dollars and cents, but has been by some qualified observers placed at 40 to 50 million dollars per year. Its volume is indicated in the preceding tabulation, which represents (incompletely) the construction results of nine months' work from April 1 to Dec. 31, 1934:

It would probably be unfair to claim all of this work as extra work, that is, work that would not have been done except for the availability of relief forces. A good deal of street repairing, maintenance and improvement of public buildings, extension of water mains and improvement or reconstruction of sewers, would undoubtedly have proved to be necessary even in the present economy period of municipal administration. Probably some of the park improvement and modernization would also have been carried out. On the other hand a very large amount of the work done would have been long deferred but for the availability of relief workers. This applies primarily to the engineering construction projects.

Credit to Colonel Wilgus

Until his resignation three weeks ago, when he was succeeded by Francis Boardman (who also was developed in the New York Central R. R. engineering department), Col. W. J. Wilgus was in directing charge of the works division for a period of eight months, having been called last September from retirement to undertake the work and accepted it as a civic responsibility. He had the experience of many public servants in finding that political and personal criticism was his chief reward, and because of this criticism some weeks ago presented his resignation, to become effective on the close of the aldermanic inquiry then in progress. He is entitled to chief credit for developing the works division to its present thoroughness of organization and functioning, which is the result of his administrative ability, keen judgment and hard work.

Colonel Wilgus not only assured the sound and absolutely clean conduct of the work during the eight months of his incumbency, but also developed the organization and its spirit to such a point as to assure continued efficiency of the division's operations. This result is the more notable because of the special difficulties that hampered progress—chiefly the many restrictions that were placed upon free and effi-

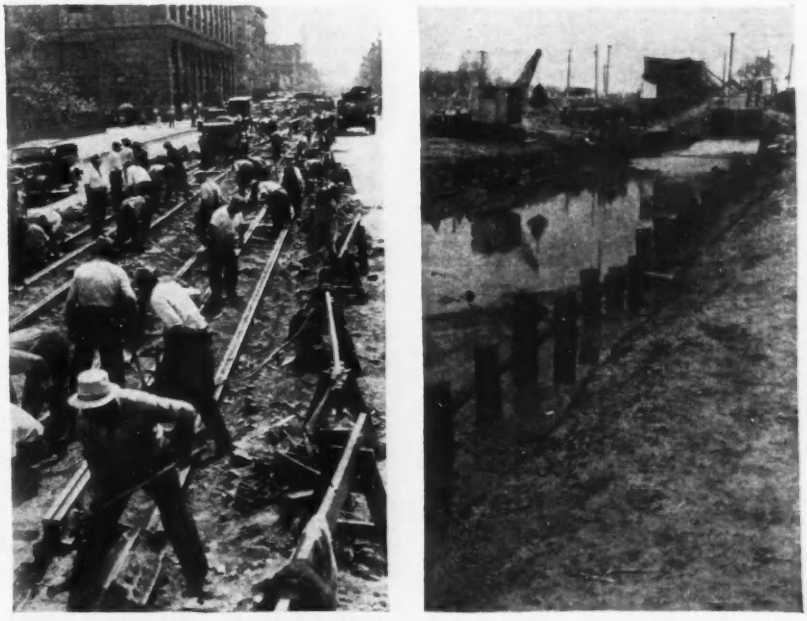


FIG. 5—CLEARING STREETS of obsolete cartracks, cleaning up and confining sewer outfalls are types of useful relief-work projects undertaken by the works division.

cient handling of labor, on control of planning, on purchase, execution and accounting.

Even cursory inspection of methods and results indicates that work-relief construction is of special character and is subject to marked limitations. Some of the conditions that differentiate it from regular construction operations were mentioned in an earlier paragraph, but in addition the following characteristic features give expression to certain of its attributes and limitations:

1. Work-relief construction has a human value difficult to overestimate. It is also a highly successful means of saving part of the lost productive power resulting from unemployment, as shown by the large total of permanent work performed. It is probable that both these effects might be increased if the relief construction program were carried on with a greater degree of autonomy rather than as a subsidiary element of a relief movement.

2. The efficiency attained is necessarily low. Careful direction can increase production and reduce costs, but results equal to contract work or normal force account work are not obtainable.

3. Under the system of initially classifying and rating men elsewhere than in the construction division itself, men may be assigned to work that is unsuited to their ability. This leads to frequent delays, hardship to the workers, and reduction in efficiency.

4. Normal discipline, good working spirit and energy in the working forces are not easily maintained, because of low working time and rate of pay, alternating shifts, restricted facilities for procuring materials and equipment, and lack of the usual means for controlling the men.

5. Construction programs and social programs differ essentially in their objectives. In consequence effective cooperation to assure desirable construction results is not easy to bring about.

6. Work-relief construction tends to react harmfully on normal employment. There is a tendency for municipal bureau heads to displace regular employees by relief workers. The relief construction projects often represent work that, but for the availability of relief labor, would have given employment to engineers, contractors and free labor; these are deprived of an important part of their normal working opportunity by the relief program.

On the whole, regardless of these limitations, the record of work done in New York City during the past year under the work-relief program is surprising and gratifying evidence of what can be accomplished even under conditions that require the planning of projects to originate in more than 100 different sources. It is a testimonial to the administrative skill of those who direct the work.

Book Reviews and Notes

A Monthly Commentary on Current Additions to the Civil Engineer's Library

Clean Water

Reviewed by Gordon M. Fair
Associate Professor of Sanitary Engineering
Harvard University

ELIMINATION OF TASTE AND ODOR IN WATER — Engineering Societies Monographs. By John R. Baylis. Tables, diagrams, half-tones. Cloth; 6x9 in.; 392 pp. Published by McGraw-Hill Book Co., Inc., New York and London. Price $5.00.

IT IS the objective of modern water-supply works to deliver to the consumer an abundant volume of savory as well as safe water. As the late Professor George C. Whipple stated the situation twenty years ago, "The demand for clean water is growing. Popular standards of purity are rising. Our cities need water of such quality that the people not only can drink it with safety, but will drink it with pleasure."

Much has been done in the intervening years to facilitate the production of clean water, and the author of this monograph, Mr. Baylis, has had a significant share in creating the necessary adjuncts to treatment and in consolidating the advances made.

The author has restricted his thesis essentially to the elimination of odor and taste from water after it has been received at the purification works. No attention is given to odor prevention by the control of water sources, such as the destruction or prevention of plankton growths and the exclusion or diminution of pollution by odor- or taste-producting substances.

The first chapter describes the characteristics of odors and tastes in water and gives methods for evaluating their quality and intensity. Spaulding's "threshold" determination of odor and taste intensities is advanced, and his water-dilution method for accomplishing it is elaborated. The author does not discuss the underlying anatomy and physiology of the senses of taste and smell that are necessary to a full understanding of odor and taste measurements.

The next eight chapters, covering more than half the book, deal with activated carbon: its history, characteristics, use and evaluation in removing odor and taste from water. These chapters constitute, in the reviewer's opinion, the most original and valuable part of the monograph. Into the last six of these chapters the author has poured the wealth of his experience in laboratory and plant to give the reader insight into the wide and varied conditions under which activated carbon can be economically employed to eliminate odor and taste from water. In these chapters Mr. Baylis has generalized the findings of his exhaustive work and supported his conclusions with detailed results selected from a remarkable series of laboratory and plant-scale studies. The information gathered redounds to the credit of the author and the city of Chicago, which sponsored the researches. It is to these chapters that engineers and operators will turn in order to receive information on the selection, handling, application and testing of activated carbons.

Many pages in this section of the monograph are devoted to the phenol test for evaluating the adsorptive capacity of carbon. Conformity of phenol adsorption to the Freundlich equation is established, and the reliability of phenol adsorption as a measure of the capacity of carbon to remove different types of odors and tastes is argued. In the light of the Freundlich equation, the reviewer cannot agree that the author's proposed "phenol value" and "phenol number" are unique measures of adsorptive capacity. They can be employed in the manner suggested by the author only when the exponent n in the equation is the same or very nearly the same for the carbons that are to be compared. It so happens that with rare exceptions the carbons tested by the author conformed to this requirement, but it remains to be shown whether or not this is a sufficiently common characteristic of activated carbons to permit the general acceptance of the author's methods.

Chapters 10 to 12 are devoted to the ammonia-chlorine process, its history, method of application and use in water treatment. The prevention of tastes by combining ammonia with chlorine is well summarized. Scant recognition, however, is given to the oxidation potential concept of chlorination and chloramine treatment, and the author confines his discussion chiefly to the nascent oxygen theory without pointing out its essential unsatisfactoriness.

Chapters on superchlorination, on aeration and on ozone, potassium permanganate and bleaching clays complete the monograph. The discussion of aeration is novel in viewpoint and should contribute substantially to the intelligent use and design of aerators.

Lists of references are appended to the various chapters. Examination of them indicates that publication of the monograph has been delayed longer than anticipated by the author.

Miscellaneous Notes on Booklets and Reprints

A TEN-YEAR HIGHWAY CONSTRUCTION PROGRAM for the state of Maryland is outlined in a report published by the State Planning Commission, Baltimore, Md. For details see *ENR*, May 16, 1935, p. 709.

OCCUPATIONAL OPPORTUNITIES and the economic status of recent graduates (1928-1934) of Purdue University are given in a report recently published by the university (Lafayette, Ind.) in pamphlet form.

THE HISTORY OF GRAND COULEE DAM and of the Columbia Basin project is given in the second report of the Columbia Basin Commission of the State of Washington, published by the Department of Conservation and Development, Olympia, Wash.

THE STRENGTH OF LIGHT STEEL JOISTS is the subject of *Bulletin No. 79* of the Engineering Experiment Station of the University of Wisconsin, Madison, Wis. It describes a laboratory investigation made on various types of steel joists by Prof. M. O. Withey and Instructor K. F. Wendt. Price, 25c.

OBSERVATION AND RECORD OF PRESSURES below works on permeable foundations, a paper by A. N. Khosla, has been published by the Central Board of Irrigation, Simla, India. The study is closely related to similar studies of the Punjab Irrigation Research Institute noted in our issue of April 25, p. 600.

FEES FOR PROFESSIONAL SERVICES on federal projects and federal-aid projects undertaken to aid industrial recovery or to relieve unemployment, and salaries of civil engineers are outlined in two reports prepared for the American Society of Civil Engineers. The two reports have been printed in a pamphlet that may be obtained from the society, 33 West 39th St., New York, N. Y.

ORDER AND EFFICIENCY in the future capital expenditures of municipalities are the goals of city planning, according to a "Statement for Chambers of Commerce" issued by the construction and civic development department committee of the Chamber of Commerce of the United States. This 8-page pamphlet, the first of a series to be sent to Chamber of Commerce executives, gives an understanding view of the place of planning in the modern city. It deplores the undue emphasis of some earlier plans on beautification and luxury-class improvements and stresses the practical value of a basic comprehensive plan for a community's physical development. Included in a plan as defined are analyses, maps and factual data concerned with major street pattern, transportation facilities, public utilities, sites for public buildings and parks and the areas best adapted for residential, commercial, industrial and public uses. The work urged on Chambers of Commerce is to give city-planning officials their proper status and to help obtain citizen support for planning work.

THE COLORADO RIVER AQUEDUCT is described in an interesting manner in a booklet entitled "On the Aqueducts of the Pacific," put out by the Atlas Powder Co., Wilmington, Del. Brief descriptions of the Hetch Hetchy and Owens Valley aqueducts also are included.

EXPERIMENTAL STUDY OF POROUS PLATES for use in filter bottoms for rapid filters, a paper by Thomas R. Camp before the New England Water Works Association, has been reprinted from the *Journal* of the association by the Department of Civil and Sanitary Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

A SPECIAL JUBILEE SECTION has been published by *Engineering*, London, with its May 3 issue in honor of the King's Silver Jubilee. The special section is devoted to a review of 25 years of progress in science and engineering, each section being written by an eminent authority in the field under discussion. Illustrations are page plates of engineering structures throughout the British Empire.

EFFECT OF BORON ON PLANTS is outlined in Technical Bulletin 448 issued by the U. S. Department of Agriculture, Washington, D. C.; price 20 cents. This 132-pp. bulletin relates to studies on boron in soils and irrigation in the San Joaquin Valley, California. Boron in some form appears to be essential to the growth of many if not all plants but is highly toxic to many plants when present in the soil solution in concentrations of more than a few parts per million. When applied in irrigated water it tends to accumulate in soils. Practical methods of removing the boron from irrigation water or counteracting its effects have not been found.

PROF. F. H. ENO epitomizes his research and studies of nearly a decade and a half into the effects of soil, water and climate upon the construction, life and maintenance of highways in *Bulletin No. 85*, Engineering Experiment Station, Ohio State University, Columbus, Ohio. The earnest work that Professor Eno has devoted to his chosen subject is well known to all who have followed road engineering through the period of its greatest activity, and they will welcome this rounded-out record of that work. The subject matter is divided into chapters on soils, subgrade treatment under concrete pavement, subgrade treatment for traffic-bound roads, subdrainage of highways, special soil conditions and seven appendices. Tables and diagrams are profuse, and in all respects the publication gives evidence of painstaking labor.

THE COOPERATIVE SYSTEM of educational training as practiced at the University of Cincinnati is discussed in a pamphlet entitled "Thirty Years of Educational Pioneering, the Philosophy of the Co-operative System and Its Practical Test," by Herman Schneider, dean of the College of Engineering and Commerce, Cincinnati, Ohio. The cooperative course in civil engineering was begun in 1909. For the academic year 1934-35 the enrollment of day cooperative students in all courses totaled 1,562, and the evening course enrollment is 3,994.

New Books and Revised Editions

[Those desiring copies of the books listed below or mentioned elsewhere in this section should order them from the publishers or from their local booksellers.]

THE BOOK OF STAINLESS STEELS—Second Edition: Edited by Ernest E. Thum. Cloth; 6x9 in.; pp. 787. Photographs, tables, diagrams. Published by The American Society for Metals, Cleveland, Ohio.

CORROSION—CAUSES AND PREVENTION—By Frank N. Speller—Second Edition: Cloth; 6x9 in.; pp. 694. Photographs, tables, diagrams. Published by McGraw-Hill Book Co., New York and London. $7.

DER EISENBETONBAU-Teil III Rechnungsbeispiele aus dem Hoch baugebiet C. Kersten. Paper; 5x7 in.; pp. 219; diagrams. Published by Wilhelm Ernst & Sohn, Berlin, Germany. 6. RM.

THE MUNICIPAL YEAR BOOK, 1935—Edited by Clarence E. Ridley and Orin F. Nolting. Cloth; 7x10 in.; pp. 392; tables. Published by International City Managers' Association, 850 East 58th St., Chicago, Ill. $4.

PRINCIPLES OF HIGHWAY ENGINEERING—Second Edition: By Carroll Carson Wiley. Cloth; 6x9 in.; pp. 542. Photographs, tables, diagrams. Published by McGraw-Hill Book Co., New York and London. $4.

THE PORTS OF CHARLESTON, S. C., AND WILMINGTON, N. C. (Revised, 1934). Port Series No. 9—Prep. by Board of Engineers for Rivers and Harbors, War Department. Paper; 6x9 in.; pp. 187. Maps, tables, photographs. Obtainable at U. S. Government Printing Office, Washington. $0.50.

1934 PROCEEDINGS—INSTITUTE OF TRAFFIC ENGINEERS—Fifth Annual Meeting, Held at Cleveland, Ohio, Oct. 2-3, 1934. Paper; 8x11 in.; pp. 128. Published by Institute, 175 Fifth Ave., New York City. $2.50.

SEDGWICK'S PRINCIPLES OF SANITARY SCIENCE AND PUBLIC HEALTH—By Samuel C. Prescott and Murray P. Horwood. Cloth; 6x9 in.; pp. 654. Published by The Macmillan Co., New York. $4.25.

A SUPPLEMENT TO A NATION PLAN—A Basis for Co-ordinated Physical Development of the United States of America—By Cyrus Kehr. Paper, 8x10 in.; pp. 41; 1 drawing. Privately printed by Cyrus Kehr, Washington, D. C. . . . *Added comment on the author's "triangular plan structure" which he proposed in A NATION PLAN as the basis for national planning (ENR, Jan. 20, 1927, p. 123).*

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May 30, 1935

Consolidate the Gains

AS THIS ISSUE goes to press the Supreme Court's momentous decision on industry codes has just been handed down. Comment upon the decision is impossible until there is opportunity for careful study of its details and for considered determination of its effect upon the construction industry. But this fact stands out: the decision simply advances by three weeks the inevitable reorientation of the whole code set-up under the National Industrial Recovery Act that was due on June 16 when the present act would have expired automatically. Regardless of what Congress might have done in the interim to extend the act, it was apparent to all that too much had been attempted under the present act and that the codes, if continued at all, must be greatly simplified. This, as we have repeatedly pointed out in these pages has placed upon each industry the responsibility of being prepared to save the good in its code and to scrap the impracticable. For the construction industry this means that it must be prepared within the next few days to advise Congress or the NRA as to what elements of its code should be saved and may be saved in the light of the Supreme Court's decision. Further, the court's decision, resulting as it may in the scrapping of the existing industry codes, increases the obligation of the construction industry to be prepared, in that event, for some organized effort to consolidate and extend the gains that it has already made under the codes. This will mean the definition of objectives and the provision of means by which the industry can deal with its more urgent problems under self-imposed regulation, plus such governmental enforcement as may be consistent with the ruling of the Supreme Court.

Speed is Money

THE POSSIBLE LOSS to highway building of nearly a third of a billion dollars will be the penalty of any but the fastest action by federal and state highway officials in getting their relief-works allotments obligated by construction contracts. As stated last week, only $500,000,000 is now allotted of the $800,000,000 relief-works fund for highways, and it has been rather plainly implied that the granting of the remaining $300,000,000 is in abeyance until the present half-billion grant is being absorbed in payrolls. To do this, it is repeated, requires fast work. Despite the rather marvelous records of past years it is not an easy task to plan and put under construction sound highway improvements costing $500,000,000. Only two-thirds of this year's working season remains, and then comes the handicap of winter and early spring frosts and rains. In this time and period some 15,000 miles of road and 2,500 grade-crossings must have been put under construction to spend half a billion. And further it has to be spent fast enough to demonstrate that $300,000,000 more can be gainfully obligated before the nominal life of relief-works appropriations ends in 1936. The situation allows of no delay, and critical time has already been wasted. Waiting for things to come about will not serve. Things have to be made to come about; and to accomplish this, action must be spurred by all highway interests as it never before has been.

Winter Work Vital

IF $800,000,000 OF HIGHWAY WORK is to be realized in pay checks within the duration of relief-work grants, the coming winter must see continuous work on thousands of road jobs. Cold-weather operations cannot be turned to overnight unless the contract is organized. Plans must be laid far ahead for the roadbuilding that will extend into and through the winter, and it must be a part of specifications that contracts are organized and equipped for frost and rain conditions. The increase in bidding prices will be insignificant when balanced against the profits to labor from winter employment. A well-developed technique of cold-weather construction is at the command of contractors, and not far from half of the relief-work road money (that for grade crossings) is for structures to which frost-protection practices are best adapted. They should everywhere be planned for continuous work through the seasons. There is rarely any compelling reason why any road work, except certain surfacing details, should regard the month of the year in its planning. Busy road jobs this next winter will do much to protect the stake that highway interests have in relief-work funds that remain to be granted.

Relief Wages

DESPITE violent criticism by representatives of organized labor, the wage-rate schedule for the new relief-works program as determined by Presidential order last week is sound and sensible. Labor's fears that industrial wages will be pulled down to the level of the new relief scales are groundless, for at least half of the work to be done with the new funds is exempt from the low-rate provisions of the order. Wages to be paid on all highway, grade-crossing, PWA and federal building projects will be determined by state and local authorities with assurance that the scales will be adequate. The CCC, which comes in for a substantial share of the new funds, will operate as at present. About all that is left for operation under the executive order rates are relief projects originated and carried out by the federal government. After all, this is a relief-works program, with the government making a determined effort to turn the current huge outlay for relief into more useful expenditures. To put the entire relief list on a high standard of wages is an economic impossibility.

An Idle Thought

ENORMOUS YARDAGE RECORDS have become commonplace in concrete dam construction. Boulder Dam operations first captured attention with monthly six-figure volumes of concrete in place, and now Norris Dam is reporting in superlatives, as related in the May 16 issue. In both dams the speeds of concreting are something marvelous. What is the relative efficiency of concreting? Mere monthly-volume figures are no indication. Comparative unit costs are better indices but still do not answer the question. Some expression in terms of mechanical energy is indicated. Suppose that instead of recording Norris Dam progress of 87,000 cu.yd. a month, the figures showed footpounds of work required in producing

and placing a unit of concrete. Would the comparison of such figures from, say, Boulder Dam and Norris Dam throw real light on relative efficiencies of plant and methods? The task would be tedious, but if some diligent computer should try for results they might be instructive. Meanwhile the yardage figures from Norris Dam stand as further testimony of the perfection reached in mechanization and plant coordination for volume production of concrete.

Virile Purpose

RECENT CONDITIONS focus attention on the strong trend toward cooperation among engineers during the past two decades. Expressing itself in various ways, now as a mutual welfare movement, now as an effort to carry engineering influence into public affairs, now as an organization to serve public safety by research, standards or registration, it always was a response to the new questions placed before the profession by the growing complexities of present-day life. Therein lies its importance.

The joint-activities meeting of the national societies held at New York a week ago is one of the current evidences of the virile purpose inherent in the cooperation movement. Others are the twentieth-anniversary celebration of the American Asociation of Engineers a week earlier, the gravitation of interest toward a central forum for registered engineers, and the campaign to establish a permanent abstract service for the literature of the profession.

In particular, the joint-activities meeting left no doubt about the evolution of new forces and new orientations that is in progress. Research and standardization, active representation in governmental affairs, and guidance of the profession's growth and structure are functions far different from any recognized in the earlier individualistic era of technical society life, but they are so essential that they may be regarded as the key to the future. Indeed, the cooperative trend promises to mark an epoch in engineering history just as definitely as did the founding of the great societies in the preceding century.

To look at some of the beginnings of cooperation, consider the conditions back in 1915, when the A.A.E. organized for welfare work. In those days engineers still were so committed to the older traditions that the word "welfare" appeared vaguely related to poorhouse charity; yet many were then walking the streets, without aid from a sympathetic, understanding employment service and in the face of a supply-and-demand practice that reduced professional compensation often to the starvation point. The organization that took form under these conditions was a protest against old views. It first attacked the bread-and-butter problems of the profession and later did yeoman service in promoting licensing.

Modernizing tendencies within the established societies became active about the same time. The call to participate in public affairs also made itself felt, and the development now embodied in the American Engineering Council had its beginning. Professional centralization went forward as licensing became established to safeguard the public's concern in sound engineering. Cooperative standardization work was undertaken. Fellowship between the national societies, joined in headquarters and library and in employment service, grew apace. Research became another bond of union; and so the advance in cooperation proceeded, to the newest activity, the Engineers Council for Professional Development.

The virility of purpose of this cooperation has become steadily greater. In succession each separate movement won broad recognition and became an accepted part of society work. That the present powerful group of joint functional-service agencies will accomplish much for professional progress needs no emphasis. The prominent fact is that they express a realization by engineers that their responsibilities to themselves and to the community can in these modern days be discharged only through cooperation.

What will develop in the further and fuller progress of cooperation cannot now be foreseen. Will there be a return to integration of the profession? Will refusion of the profession come about, after decades of differentiation? Will the major societies gain or lose? And what of the local and specialist societies? It would be idle to speculate. Beyond question, individuality of engineering function will always be preserved, for it is the soul of professional vigor. Within due limits, however, there is every certainty that cooperation will make much further progress. It is yet a young movement, hardly begun to grow, and with its further evolution we may look forward to large results in the coming years.

In this prospect a broad participation in the profession's cooperative movements, with every engineer giving his best thought and asistance, becomes a welcome obligation. Through such participation it is possible to hasten the time when the profession shall attain to greater strength to do its part in leading the world on to better days.

Added PWA Inducements

AN INCREASE in the amount of the grant for PWA work from 30 to 45 per cent and a reduction of interest rate from 4 to 3 per cent, as announced last week, was to be expected in view of the Administration's desire to get the largest possible number of unemployed back on useful work as quickly as possible. The files of the PWA show that there is a large reservoir of useful work in supplying community services that can be put under construction through normal channels; but since the FERA took over many of these projects for its relief-work program—paying for them entirely out of the federal treasury—there has been increasing reluctance on the part of cities to put up their own money for part or all of the cost. Their officials ask why they should put up the money when the government may yet take the work over as it did in many cases last year. The larger grant and lower rates now offered make that sort of a gamble less inviting, especially for projects like water supply and sewage disposal, on which it frequently is necessary to purchase property and a considerable amount of permanent equipment.

When it is realized that the new financing plan announced by the President brings the total interest charge to below 2 per cent, such potential income-producing services are placed in an especially attractive class. An added inducement is the provision in the new wage-rate order for local fixing of rates to be paid on PWA work. If the Administration now would put forward a simple plan for advance financing of the necessary engineering studies, many such projects ought to be forthcoming.

CURRENT NEWS

Liberalized Grants For PWA Projects Approved

LIBERALIZATION of the loan and grant basis for non-federal PWA projects has been approved by President Roosevelt on recommendation by the Advisory Committee on Allotments.

In order to reduce the cost to the government of re-employing men in the relief works program by loaning more money instead of making outright 100 per cent grants the Advisory Committee on Allotments recommended to the President:

(1) "That the rate of interest on loans for projects of states, territories, possessions, including sub-divisions and agencies thereof, municipalities, and the District of Columbia, and self-liquidating projects of public bodies thereof be fixed at 3 per cent;

(2) "That the amount of the grant for the normally acceptable project be fixed at 45 per cent of the cost of such project; provided, however, that the Federal Emergency Administrator of Public Works shall have authority, after careful investigation of the financial condition of any applicant in the foregoing classification and the nature and work-producing character of the project, to recommend to this committee a variation in the amount of the grant."

Under the old PWA procedure an outright grant of 30 per cent was made to the local authority undertaking the project and the balance of the cost was provided by a loan at 4 per cent interest. Lower interest rates have made it possible for the PWA to sell at a profit about $85,000,000 worth of bonds received as security for previous loans and more bonds will be sold as soon as they are available.

Liberalization of the grant from 30 per cent to about 45 per cent of the project cost and reducing the interest rate to 3 per cent is designed to get non-federal agencies cooperating more fully in the relief works program. It will make it easier for communities to borrow money on collateral instead of seeking outright grants and will aid in the government's objective of returning a large portion of the money to the Treasury. The terms apply only to non-federal PWA projects carried on with funds appropriated under the Emergency Relief Appropriations Act of 1935 as part of the relief works program. No changes will be permitted in allotments made from the original PWA fund.

Denver Approves Bond Issue For $2,000,000 Disposal Plant

A bond issue for a sewage disposal plant in Denver, Colo., was approved by the city in a referendum held on May 21. The bond issue provides for the sale of $2,000,000 worth of securities to finance the construction of the disposal plant.

N. Y. Bill For Crossing Work Under P. S. Commission Vetoed

Governor Lehman of New York on May 16 vetoed a bill passed by the legislature (*ENR*, Apr. 25, p. 606) which sought to place control of New York's federally financed grade crossing elimination program under the Public Service Commission.

The governor's action was taken after an extensive study of the grade crossing situation as presented by the division of highways of the department of public works, and the Public Service Commission, following opposition to the bill on the part of organized contractors. Fear was expressed in construction circles that the program about to be released by the federal government would be subjected to delays unless all grade crossing and highway work was placed under a single state department such as the division of highways, and the excellent record of speed made by that deparment on both classes of work in recent years was cited in a brief filed with Gov. Lehman on the subject by the New York State Highway Chapter of the Associated General Contractors of America.

The Public Service Commission will continue to administer grade crossing elimination work which is being paid for out of state, county and railroad funds under a program started in 1926 but not yet completed. This work will be carried forward by the railroads as formerly as they are assessed half the cost.

Supreme Court Holds Industry Codes Unconstitutional

ALL CODES promulgated under the provisions of the National Industrial Recovery Act were declared to be unconstitutional by the U. S. Supreme Court in a unanimous decision handed down on May 27. The court held that the code-making powers given the President under the NIRA was an unconstitutional delegation of legislative powers.

Labor rates and hours

The court also ruled that Congress was without power to pass laws regulating hours and rates of pay in industries whose operations only affect interstate commerce indirectly. The construction industry falls into this class.

As this is written (May 28) it is not known what action is to be taken to meet the changed conditions resulting from the Supreme Court's decision. Donald Richberg, chairman of the National Industrial Recovery Board, in announcing that all code enforcement provisions were suspended, appealed to employers to maintain the wage and hour standards established under the codes. Further, he called attention to the fact that voiding of the code provisions of the act did not void contractual relations established under the code.

Less Than Half of Works Program Affected by Low Wages Scale

(Washington Correspondence)

THE SCHEDULE of relief works "security payments," which organized labor regards with such dire misgiving, will apply to less than half of the $4,000,000,000 works program. Other wage scales apply to road construction and railroad grade crossing elimination, to municipal loan-and-grant projects, to the Civilian Conservation Corps and to such federal buildings as may be included in the program. Exclusive of federal buildings, the allocations for work in these special wage groups total $2,300,000,000. It is probable that the new PWA scales on the $900,000,000 allocation for non-federal projects will also apply to the $450,000,000 slum clearance and low-cost housing program.

The PWA scale established in August, 1933, pays 40, 45 and 50c. an hour for common labor; $1, $1.10 and $1.20 for skilled labor, regionally, in the South, North and West. Rates on new PWA operations are to be determined "in accordance with local wage conditions" by the recipient of the loan, subject to approval of the state administrator. On the $800,000,000 highway program, each state fixes its own wage scale. Forty cents an hour for common labor represents an average for rates which vary regionally from 30c in the South to 45c in the North and 55c. in the West. In the CCC, for which $600,000,000 is allotted, the enrollees are paid $30 a month plus food, clothing and shelter. On all federal buildings, the rates prevailing in the community will be paid in accordance with a provision that the American Federation of Labor succeeded in writing into the law when the bill was in the Senate.

Wages of organized labor not affected

In view of the wage rates that will apply on these major features of the work program that normally employ the construction trades it is very doubtful whether union labor will be able to show that the low wage schedules on work of a more distinct "relief" character will have any tendency whatever to pull down rates in private employment.

The relief works program does not represent any disposition by the administration to take exception to the wage and hour scales which organized labor is seeking to maintain, but it is a demonstration that the federal government does not intend to support idle labor permanently, either by a dole or by relief work. The new program is, in fact, merely an expansion of the FERA emergency work program which now employs 2,500,000 of the 3,500,000 that,

at the peak, will get temporary work on the $4,000,000,000 program.

Comparison with FERA wages

Converting the schedule of monthly payments set up for the new program into rates per hour discloses that, on the basis of a 40-hour week, the rates for common labor are lower than those paid on the FERA program which, in accordance with FERA's policy, reflect prevailing rates in private industry. A survey by FERA of common labor rates on public emergency work programs in 3,000 counties, grouped by size of the largest city within the county, furnishes a direct comparison with the wage schedule for common labor employed on the new relief works program.

AVERAGE HOURLY WAGE RATES FOR COMMON LABOR

Population of largest city in county	*Rate under new relief works program (cents)	Rate under FERA work program (cents)
Under 5,000	23.0	30
5,000-25,000	25.3	37
25,000-50,000	27.6	42
50,000-100,000	30.0	42
Over 100,000	31.7	49

*In this comparison, the schedule of rates for Region No. 1 was used, as this is the highest (*ENR*, May 23, 1935, p. 756).

Both the rates paid by FERA and the new relief works rates vary as between large regions. At 10-20c. they are about even in the South but elsewhere FERA rates climb much higher, reaching a top of 40-50c. in the North and West as compared to 25-30c. under the new relief works program.

Low rates aimed to discourage relief seekers

The new wage rates have been attacked as insufficient for family support and Administrator Hopkins admits that household budgetary requirements have been ignored. Only one member of a family will be employed, but his earnings will be supplemented by direct relief to some extent. Of the 2,500,000 employed on FERA's work program, 900,000 also receive direct relief. The amount of such relief in the future, however, will depend largely on the funds raised by states and local communities.

In this relief works program, the administration is trying above all else to spend its way out of the relief business. Part of its strategy is to pare down relief, distributed either in the form of earnings on work projects or as direct relief allowances, to the point where everybody now on relief rolls who is able will get out and hustle. The relief works program will succeed in its real objective to the extent that private industry cooperates by putting into new pay envelopes the toll now collected for the support of public relief and public employment.

Colorado Road Job Halted Over Code Assessment

The U. S. Bureau of Public Roads has instructed the Colorado state highway department to revoke the contract given to W. A. Colt & Son of Lyons, Colo., for construction of 4.7 mi. of road on Wolf Creek pass. With about one per cent of the work done, it is claimed that the contractor refused to pay the assessment stipulated by the divisional code authority for general contractors.

CCC Camps Assigned for Work Under Bureau of Reclamation

Under the expanded CCC program 46 camps will be assigned to Bureau of Reclamation projects. These projects, to be located in fourteen states, will employ 9,200 men. Of these camps 37 will be new camps that have been provided for under the recently approved enlargement of CCC forces.

The work to be done on these projects will be typical of the irrigation projects in the arid sections of the West, but does not include the work to be done by the 505 camps recently assigned to the Soil Erosion Service. Maintenance of irrigation systems, removal of trees and vegetation, lining canals, and the construction of levees will be among the duties of the CCC men.

TVA Considers Extending Lines in West Tennessee

A web of power lines through rural west Tennessee, using eight of the largest cities other than Memphis, Tenn., as focal points and serving a territory with a population of about 500,000, may come as the result of a survey begun by the TVA.

At the request of the Tennessee Valley Commission, appointed by Gov. McAllister of Tenn., and the west Tennessee TVA association, composed of municipal officers, the TVA has sent men to visit the cities of Jackson, Milan, Trenton, Union City, Dyersburg, Somerville and Bolivar. The TVA expects to use the statistics developed in this survey to offer contracts to the various municipalities. Each of the cities owns its own power plant.

It is proposed to hook up lines from the cities at Pickwick Dam, near Savannah, Tenn., with the power line being built from Wilson Dam, and then to branch out through the country in accordance with President Roosevelt's rural electrification program. The counties of Lake, Madison, Hardeman, Fayette, Lauderdale, Gibson, Crockett, Weakely, McNairy, Henderson, Haywood, Dyer, Tipton, Obion, Carroll and Chester would be served with TVA lines from such a circuit. Sufficient surplus power will be available from TVA operations for use of these cities when the power line to Pickwick Dam is completed which is expected to be done within a few weeks, although no estimate of power required has been made.

Aerial Explorations

SUPER-LINER TERMINAL IN NEW YORK NEARS COMPLETION

When the French Line's 1,029-ft. superliner *Normandie* arrives in New York June 3 on its maiden voyage it will dock at a new 1,100-ft. pier (on the right in the above view) whose design is as modern as that of the ship itself. Some months later the Cunard-White Star super-liner *Queen Mary* will berth in the adjacent slip alongside a similar pier terminal. Farther in the future the steel superstructure on the third pier (two stories high as compared with the three-story structures now under construction) will be erected and probably used by the Italian Line. Work on the latter two piers is scheduled for completion on Oct. 1 and Dec. 1, 1935, respectively.

The new French Line pier, known as Pier 88, is located at West 48th St. and the Hudson River. Its facilities for disembarkation are said to be unequaled anywhere else in the world. The three-story shed permits unloading from three different decks on the ship and the three floors of the shed are to be connected by elevators and escalators. The shed will be completely finished inside and out and equipped with heating, plumbing and all necessary facilities. The sheds are 80 ft. shorter than the 1,100-ft. length of the piers. Since an 1,100-ft. pier could not be built between existing bulkhead and pierhead lines, the new slips had to be extended landward necessitating a major excavating job and one of the largest cofferdams ever built. (*ENR*, August 3, 1933, p. 123.) The piers themselves are 125 ft. wide. Structurally each pier is of two parts, the land end being on fill between concrete retaining wall while the balance is a concrete deck on timber piles; for Pier 88 the fill portion is 260 ft. long, for the other two piers it is respectively 320 and 420 ft. The slips are 400 ft. wide and a 46 ft. depth of water at mean low tide is provided.

The three piers are estimated to require a total expenditure of $14,000,000. Funds for the construction of the sheds are being furnished by a PWA loan and grant, the total cost being $4,275,000, and the grant $1,193,000. In addition to these piers, plans have either been approved or are being considered by PWA for 13 additional piers and sheds in a large-scale dock modernization program for New York Harbor.

Governor La Follette Explains Coordinated Works Plan for Wisconsin

"Wisconsin Plan" designed to end relief by building back to normal production . . . Utilizes non-profit corporation to finance relief-works projects selected and managed by a planning authority.

(Staff Interview)

"PUTTING MEN to work raking leaves will not do away with relief. But just as President Roosevelt said, we must end this business of relief. So there is a job to be done!"

With these words "Phil" La Follette, youthful and vigorous governor of Wisconsin, warmed up to an explanation of the "Wisconsin Plan," the new way of handling the relief works program that captured attention when President Roosevelt endorsed it three weeks ago and promised federal cooperation. The prosperous half agricultural and half industrial state with its 3½ million people has one-sixth of its population on relief, almost the same ratio as that of the nation as a whole. And the new federal relief works program cannot begin to provide enough jobs, even disregarding the unemployed who are not yet on relief but may soon be in dire straits.

The only hope, the governor holds, is revival of general industry and business. "The secondary employment resulting from a works program is what we must depend on. By buying materials and machines we can activate the secondary employment that will build back to the normal income of the community, and by restoring self-respect and every man's confidence in his own ability to make a living we can make the effect lasting." That belief is the foundation on which the "Wisconsin Plan" rests.

Relief works to end relief

Stated in another way, the objective is a balanced budget. The protests we hear about our unbalanced budget are perfectly sound, says Phil—everybody speaks of him as Phil, to distinguish him from his older brother, Bob, U. S. Senator—but often the protesters talk about the wrong budget. They talk about the government's budget, while it is the people's budget that counts; if the people's budget doesn't balance the government's budget can't balance.

The great job of today is to bring the people's budget back into balance. Wisconsin—the people—can't live on a billion dollar income, barely 40 per cent of its normal income. And this means that a relief works program must be so handled as to end relief.

Works as a business enterprise

A works program must be large enough and must be managed on business principles to create industrial revival. True, one unit of the nation cannot do the job alone, but it can do its part. It can use its share of the national financing, and by proper management can double it.

The program in contemplation is $209,000,000—$100,000,000 of money from the four billion relief works fund and $109,000,000 of money provided in the state itself. The sum looks large, but it is less than the state's entire annual construction expenditure in normal times. That is little for reviving industry. But it can be made of maximum effect by (1) setting it up as a business enterprise, and (2) planning and coordinating the management of the projects through a central planning authority.

These two elements of the scheme, together with the means of reimbursement, constitute the vital features of the Wisconsin Plan. So sure are the governor and his colleagues of the plan that they feel confident of being able to repay one-fourth the cost of the undertaking in three years, and one-half in ten years, *all of this out of profits.*

Plenty of work to be done

Plenty of needed work is available. Improvements that are required by local governments alone exceed the 200 millions; in addition there are highways, conservation, erosion prevention, agricultural rehabilitation, home repair and maintenance.

To protect and increase the state's $100,000,000 tourist business a large investment in forests, game preserves and highways is needed. To cut down an annual importation of $30,000,000 of feed, agricultural development by large-scale liming is essential. Soil erosion work is imperative in a score of counties to save their top soil from being wasted down the Mississippi. The problem is not to find the work but to coordinate it and put it under sound, business-like control.

Further, the kinds and distribution of work must be fitted to employment needs. The agricultural counties must have types of work chosen that will be suited to their people, the industrial counties quite different types of work.

Tentatively, allotments to the chief classes of work have been programmed about thus:

Local (municipal) projects....	$75,000,000
Conservation under a CCC system, with educational auxiliary	15,000,000
Soil erosion	7,000,000
Land liming	3,500,000
Home repair and improvement	50,000,000
Highways, half through, half county and township trunks.	25,000,000

Direct employment on projects in these classes is computed at about 100,000 men; the total program will put nearly 150,000 to work. But the secondary employment resulting, not merely in the retail necessities business, but in equipment, materials and other heavy industries, is counted on to multiply this effect.

Financing and planning corporations

The Wisconsin Finance Authority, Inc., a non-profit corporation, with all the powers and responsibilities of a private corporation, is to be the banking agency. It has already been formed, with leading business and professional men of the state as incorporators, the state budget director being the only public official.

To this body will be turned over the federal loan or contribution, made in the first instance to the governor as the agent of the state. For planning and coordinating the projects and managing the program, a State Planning Authority is to be similarly incorporated. The latter body will be able to start with the assistance of an extensive roster of projects already compiled and grouped by the State Planning Board, an organization that will continue its activities but without conflict or overlap with the planning corporation.

No less important than these bodies is the reimbursement system. A special *income-increase tax* is to be levied by the state, which will collect not on total income but *only on the profit realized*, the gain over the preceding year's income, at a rate of 5 per cent for corporations and 5 to 10 per cent for individuals. Deductions and exemptions taken into account, much of the expenditure is bound to appear as income in several turnovers (to be conservative only two turnovers have been assumed), so that a reasonably large reimbursement revenue is assured.

Operation to be decentralized

In the view of the governor it is vital to bring local cooperation and responsibility into the picture. Therefore he plans to decentralize the actual administration of the program. County highway officials, for instance, are to be active agents in handling the highway part of the program; county and city officials similarly in respect to the municipal projects.

In fact, this operation is the key to making $100,000,000 do the work of $200,000,000, says Gov. La Follette. An illustration of how it may be enlisted is this: A county that presents a $10,000,000 program, and has unemployment to correspond, would be offered (by the financing corporation) a grant of $3,000,000 if it agrees to raise $7,000,000 by an irrepealable levy of $1,000,000 a year for seven years, on 1 per cent interest. In return for such agreement the state corporation will undertake to do a second $10,000,000 of work in that county.

The long-time outlook

The Wisconsin Plan, roughly outlined in the preceding, is embodied in a bill now before the state legislature. While a hot political battle is being waged over the bill, prospects favor its early passage.

But the measure is shaped to the needs of the present emergency; there is a longer outlook back of the conception it involves. Coordinated administration of works is looked upon in Wisconsin as potentially the economic governor of business. With such central direction a works program can be increased, decreased or discontinued as a sag in the business curve may require, so as to keep up the state's production of income and thereby the economic vitality of the community to normal level.

The possibilities of the Wisconsin Plan in this direction are a matter of the future.

Swanson Named Chief Engineer Of Rural Electrification

M. O. Swanson has been appointed as chief engineer of the Rural Electrification Administration by Morris L. Cooke, Administrator. Mr. Swanson has been granted a leave of absence from his duties as division engineer for the Tennessee Valley Authority. Prior to his year's service with TVA he was general manager of the water and lighting department of Jamestown, N. Y.

Bids on Henry Hudson Bridge To be Opened on June 14

Bids on the Henry Hudson Bridge across the Harlem River at Inwood Hill Park, New York City, will be opened on June 14 by the Henry Hudson Parkway Authority.

The estimated cost of the bridge is $1,000,000. It will consist of an 800-ft. span, steel deck arch of hingeless type flanked on either end by 300 ft. of steel viaduct. The bridge will carry a four-lane concrete roadway and will have a clearance of 145 ft. above high water. The contract to be let covers both the substructure and super-structure. The structure is to be completed in 1937.

Newark City Subway Opened to Service

On May 26 the first cars were put into service on the Newark, N. J. subway. The project was started in 1929 as part of a civic improvement plan by the city in conjunction with the Pennsylvania R.R. and the Public Service Coordinated Transport. As part of this program the Pennsylvania station at Market Street has been rebuilt (*ENR*, May 9, 1935, p. 723).

The new line which follows the route of the old Morris canal will help to reduce surface traffic congestion by doing away with some existing trolley lines and will materially reduce the traveling time to and from the Newark business center.

Although plans call for extension of the line the present section in service is slightly less than four miles long. About one-fourth of this, in the downtown section, is in subway. The rest of the line is open cut with retaining walls where necessary. The right of way is double-tracked throughout.

Work is still going on for completion of the loop under the new Pennsylvania station. It will be necessary to complete the demolition of the old track approaches before work can be finished on the subway. It is estimated that the downtown loop will be finished in about a year. At present the cars run only from the Broad Street station to Heller Parkway.

Remodeled surface cars with increased speed will operate in single units over the new line. The cars are operated over the city-owned line under franchise by the Public Service Coordinated Transport.

Carey Made Project Engineer On Twin City Sewerage Work

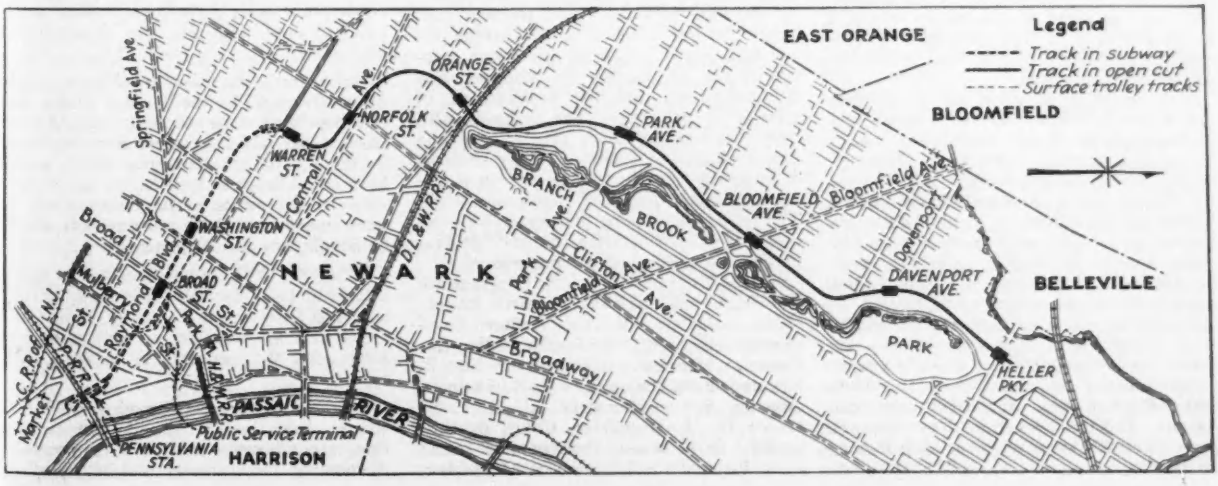
W. N. Carey state PWA engineer for Minnesota, has been named project engineer for the work of the Minneapolis-St. Paul Sanitary District now being carried out with PWA funds. Mr. Carey is a member of the engineering board for the district named by the PWA last year. He is to continue as state PWA engineer and as acting state director for the PWA. Harry L. Wilson has been named as principal assistant engineer, Theodore Jensen, designing engineer, and J. E. Larson, mechanical engineer.

C. C. Wilbur is to continue as chief engineer of the district and the engineering board is to be retained in an advisory capacity. Direction of the engineering work of the sanitary district has been a subject of controversy between the two cities ever since the work was undertaken. A board consisting of Brig.Gen. C. W. Kutz (retired), Prof. Frederic Bass, D. W. Townsend, the late George W. Fuller, and W. N. Carey, was named by the PWA in June of last year following a disagreement over a contract for private consulting services.

P.W.A. Engineers Become Acting State Directors

PWA state engineers are to serve as acting state directors in the Public Works Administration decentralization that is now in process. Their offices will be used as headquarters for the technical personnel of attorneys, financial examiners and examining engineers sent from Washington headquarters in the PWA decentralization. A list of state engineers and their headquarters follows:

Ala., H. S. Geismer, Box 669, Montgomery.
Ariz., H. S. Reed, Professional Bldg., Phoenix.
Ark., Alex. Allaire, Federal Bldg., Little Rock.
Calif., A. D. Wilder, 805 Washington Bldg., Los Angeles.
Colo., G. M. Bull, Custom House, Denver.
Conn., L. A. Hoffman, Johnson Bldg., Bridgeport. (Also for Rhode Island).
Fla., J. E. Cotton, Exchange Bank Bldg., Tallahassee.
Ga., J. H. Johnston, Citizens & Southern Bk. Bldg., Atlanta.
Idaho, I. C. Crawford, Univ. of Idaho, Moscow.
Ill., C. M. Osborn, U. S. Court House Bldg., Chicago.
Ind., E. M. Logan, Federal Bldg., Indianapolis.
Iowa, P. F. Hopkins, Federal Court Bldg., Des Moines.
Kan., R. E. Lawrence, Federal Bldg., Topeka.
Ky., G. H. Sager, Jr., Federal Bldg., Louisville.
La., Orloff Henry, Masonic Temple, New Orleans.
Me., R. E. Mullaney, Federal Court Bldg., Portland.
Md., Abel Wolman, Baltimore Trust Co., Bldg., Baltimore. (Also for Delaware.)
Mass., T. B. Parker, P. O. and Court House Bldg., Boston.
Mich., M. E. Cooley, Fisher Bldg., Detroit.
Minn., W. N. Carey, Uptown P. O. & Fed. Courts Bldg., St. Paul.
Miss., H. S. Stansel, Edwards Hotel, Jackson.
Mo., Wm. A. Spann, Buder Bldg., St. Louis.
Mont., D. A. McKinnon, Federal Bldg., Helena.
Neb., J. Latenser, Jr., Fed. Office Bldg., Omaha.
Nev., R. A. Allen, Federal Bldg., Reno.
N. H., H. J. Lockwood, N. H. Bank Bldg., Concord.
N. J., C. C. Vermeule, Jr., 1060 Broad St., Newark.
N. M., G. M. Neel, Box 350, Santa Fe.
N. Y., A. S. Tuttle, 2 Lafayette St., N. Y.
N. C., H. G. Baity, Univ. of N. C., Chapel Hill.
N. D., H. C. Knudsen, Federal Bldg., Devils Lake.
Ohio, L. A. Boulay, 50 S. Third St., Columbus.
Okla., P. S. Donnell, Federal Bldg., Oklahoma City.
Ore., C. C. Hockley, Federal Bldg., Portland.
Pa., Wm. H. Gravell, State Capitol Group, Harrisburg.
S. C., J. L. M. Irby, Nat'l L. & E. Bk., Bldg., Columbia.
S. D., Wm. F. Cochrane, State House, Pierre.
Tenn., K. Markwell, American Trust Bldg., Nashville.
Tex., J. Montgomery, Fair Bldg., Fort Worth.
Utah, R. A. Hart, F. Bldg., Salt Lake City.
Vt. (see New Hampshire).
Va., J. A. Anderson, P. O. Bldg., Richmond.
Wash., E. R. Hoffman, Capitol Bldg., Olympia.
W. Va., M. L. O'Neale, 463 State Capitol, Charleston.
Wis., A. L. Kurtz, Veterans' Administration.
Wyo., F. C. Williams, Federal Bldg., Cheyenne.
Alaska, Gov. John W. Troy, Juneau.
Hawaii, Maj. Ralph G. Barrows, Federal Bldg., Honolulu.
Puerto Rico, Capt. Howard L. Peckham, Padin Bldg., San Juan.
Virgin Islands, Dr. Paul M. Pearson, St. Thomas.



NEWARK'S NEW TROLLEY SUBWAY runs over an old canal bed. Utilizing the route of the Morris Canal a rapid transit line from Newark's business center cuts commuting time to the suburbs. The loop from Broad St. to the Pennsylvania Station will be completed in about a year's time.

Colorado River Authority Awaits Legality Decision

Only one obstacle remains in the way of the construction, on the Colorado River, of four to six water storage and flood prevention dams and one or more hydroelectric plants, for which the advisory committee on allotments has approved an allotment of $20,000,000 from the relief works fund. The question of validity of revenue bonds to be issued by the Colorado River Authority as security for the government loan is pending in the state supreme court and will be disposed of soon. If the court's decision is favorable the bonds will be issued and funds made available for starting construction.

The PWA made a tentative allotment nearly a year ago of $4,500,000 for the completion of the original dam, but under the new grant this allotment was cancelled and whatever amount is required for this work will come out of the fund that will be made available if the court approves the Colorado River Authority.

Extensive Study of Pavements Begun on New England Roads

An extended study is being initiated in the states of New Hampshire, Rhode Island. and Connecticut, of the maintenance costs and the amount of traffic carried on some half dozen of the principal kinds of highway pavements.

Seven traffic observers, who will report directly to the Bureau of Public Roads of the Department of Agriculture, are already in the field and will work in close cooperation with the state highway departments, which have made the recommendations of the four-mile specimen sections of roads to be observed.

The work, so far as Washington is concerned, will head up to E. W. James of the Motor Transport Division. The program is intended to carry on for several years and to be exhaustive in its findings. It is hoped that substantial correlations may be found between volume of traffic and maintenance costs for each of the types of pavement included in the work.

Municipal Improvements Planned by Baltimore

A program of municipal improvements calling for an expenditure of $26,201,021 has been prepared by Baltimore and will be submitted to PWA officials in Washington. The city will contribute $9,910,000 toward the projects.

The program is made up of projects which can be started within 24 hours and of those which can get under way within three months to a year's time. Included among those which could be started immediately are sewers to cost $1,296,796; water works at $1,043,200; mechanical-electrical work at $314,275; repairs to streets and roads totaling $1,000,000; rebuilding piers to cost $407,250, and repairs to schools and other buildings amounting to $1,000,000.

The work which could be started within from three months to a year includes the Back River disposal plant, $750,000; widening Fayette Street, $965,000; outfall sewer disposal plant, $3,550,000, municipal airport, $1,300,000; Curtis Bay disposal plant, $500,000; water tunnel at Loch Raven, $5,300,000.

Atlanta Making Experiments on Sewage Treatment

A second series of experiments on sewage treatment has just been started at Atlanta, Ga., this time by the city itself. Under arrangements with the Filtration Equipment Corp. (of New York City), a demonstration Laughlin magnetite filter has been installed between the existing Imhoff tanks and sprinkling filters at one of the city's three old and heavily overloaded sewage treatment works. Besides putting plain tank effluent through the test filter, clarified sewage to which various chemicals have been added will be applied. Sludge dewatering by a vacuum filter will be tested, using various chemical conditions. Other tests will be made as suggested by the course of the experiments.

Tests of the Lewis process—using ferric chloride, Cottrell (cement) dust, lime and ferrous sulphate—were made at the Peachtree plant, Atlanta, March to mid-July, 1933. These tests were conducted by Parsons, Klapp, Brinckerhoff and Douglas, engineers, Alexander Potter, consulting engineer, all of New York City. Elson T. Killam, associate engineer with Mr. Potter, was in direct charge. The tests were financed by E. D. Gregory, representing the promoters of the Lewis process, owned by ex-Lieut.-Governor Charles H. Lewis. The engineers submitted estimates for several projects, some of which were for the Lewis chemical process and some for trickling filters, the activated-sludge process, and Imhoff tanks.

Before adopting any plans the city decided to make experiments of its own. It has engaged Wiedeman & Singleton to design whatever plants it may decide to build or renovate. M. T. Singleton is working on the experiments with Clark Donaldson, chief of construction, and William A. Hansell, assistant chief and engineer of sewers, of the City of Atlanta.

Civil Engineering Subjects at Atlanta S.P.E.E. Meeting

In connection with the annual meeting of the Society for the Promotion of Engineering Education in Atlanta, Ga., June 24 and 25, the civil engineering division has arranged a technical program devoted to the three subjects of soil mechanics, river hydraulics, and traffic engineering. Discussion at the first session will center on the basic principles and physical constants in soil mechanics, on percolation and hydrostatic pressures, foundation pressures, use of models in teaching and demonstrations, and the development of courses of instruction. The hydraulic section will consider such problems as the transportation of sediment, use of models in studying river hydraulics and in teaching elementary hydraulic laboratory work. The traffic engineering division will be occupied by consideration of the general problem of traffic engineering education.

Among the speakers on the program are Roy W. Crum, Highway Research Board; Glennon Gilboy, M.I.T.; Arthur Casagrande, Harvard University; W. S. Housel, Michigan University; D. P. Krynine, Yale University; R. R. Philippe, director, Soils Laboratory, U. S. Engineers; D. M. Burmister, Columbia University; F. T. Mavis, University of Iowa; K. C. Reynolds, M.I.T.; Willard Chevalier, McGraw-Hill Publishing Co.; C. C. Williams, University of Iowa, president of the S.P.E.E.; F. W. Stubbs, University of Illinois.

Attendance at the conference is open to all who are interested. Adequate housing facilities will be made available at low cost by the Georgia School of Technology. The conference is being planned by the civil engineering council, S.P.E.E., consisting of Frank Kerekes, chairman; T. R. Agg, Gordon M. Fair, L. E. Grinter, K. C. Reynolds, and Fred L. Plummer. Further information may be obtained from Professor Plummer at the Case School of Applied Science, Cleveland, Ohio.

Washington Highlights

By Paul Wooton

Apparently the National Recovery Administration has been knocked into a cocked hat by the decision of the Supreme Court of the United States in the Schechter case. While the full effect of the decision has not been appraised at this writing the feeling is that it will have a most far-reaching effect. The Agricultural Adjustment Administration has the same structure as NRA. Some think processing taxes are in danger. The Federal Alcohol Control Administration is even more directly affected. The decision may spell the death knell for the Wagner labor disputes bill and the Black thirty-hour week bill.

Passage of the banking bill by the House now make it doubly difficult for the Senate to approve titles one and three and drop out the controverted title two which vests increased authority in the Federal Reserve Board.

Regulations governing title two of the Housing Act are being extensively revised. In the changed form they will be more acceptable to the lending agencies and are expected to release large sums for home construction. The banking bill, if passed in its present form, would make mortgage loans more acceptable to bankers and would increase the money available for commercial and industrial construction.

Erosion has completely destroyed 50,000,000 acres of land in continental United States, the Department of Agriculture estimates. On 125,000,000 acres the top soil is mostly gone, while 100,000,000 acres have been damaged seriously. Soil erosion work in the future is to be conducted in cooperation with state conservation agencies. A council of five will be set up in each state.

Argentine authorities are blaming lack of construction in the United States for the depressed state of their linseed and wool trades. If there were more building in the United States more paint would be used. Carpet manufacturers use a considerable proportion of Argentine wool. If more houses were built more carpets would be bought, say the Argentinos.

While the RFC is not disposed to make industrial loans for the purpose of putting concerns together in a merger, it is perfectly willing to consider an application for funds after the merger is an accomplished fact.

Proposed amendments broadening TVA's powers have had a setback but before Congress adjourns they will be enacted. Accounting requirements will be added.

Committee Named at Montreal To Study Sewage Treatment

The executive committee of the City Council of Montreal have decided to set up a small committee to investigate the question of purifying sewage running at present from the city into the Riviere des Prairies (Back River), as directed by the provincial Department of Health. The city has named W. S. Lea, consulting engineer, as its representative and has called on the Montreal Board of Trade, and the Chambre de Commerce each to nominate one representative. J. M. Robertson, consulting engineer, has been named by the Board of Trade as its member; the third nomination has yet to be announced.

Little Rock Pushes Plans For Alum Fork Reservoir

As the next step in the move of Little Rock, Ark., to secure a more abundant water supply, efforts are being made to secure a loan from the PWA or RFC to finance the project.

In order to carry out the project, as now outlined it will be necessary for the city to obtain title to 500 acres in the Ouachita National Forest which would be flooded by the proposed lake. The project calls for a new source of water through the construction of a dam and reservoir on Alum Fork of Saline River and 37.7 miles of 39-in. pipe which would deliver water by gravity from the lake to the distributing reservoir in Little Rock.

Advisory Committee Recommends Funds for Rural Resettlement

Among the allotments recommended to the President by the Advisory Committee on Allotments is the transfer of $9,000,000 to the FERA from the $100,000,000 originally allocated to the Resettlement Administration. This money will be used to carry on the rural rehabilitation and relief in the stricken agricultural areas until Tugwell's Resettlement Administration is ready to take over the work.

General operations of the FERA are to be carried out in June with a recommended allotment of $131,000,000. Of this it is expected that about $120,500,000 will be used to cover the federal government's share of the cost of continuing work and direct relief on the present basis. About $4,500,000 will be necessary for transient relief and $6,000,000 will be for the college student aid program and emergency education. Out of prior allotments there will be carried forward about $8,000,000 for liquidations of obligations for cattle and meat products from the drought area.

Exclusive of the amount for rural rehabilitation the recommended allotment will be almost identical with the amount alloted to FERA in May. This, however, is offset because certain state and local appropriations of relief funds will not become available until July 1, making it necessary for the administration to grant larger amounts to these communities.

Among the other allotments recommended by the Advisory Committee is one to the Navy Department of $8,610,000 for use in ten of the navy yards. Most of the projects are for repairs, improvements, and modernization.

SOCIETY CALENDAR

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, Detroit, June 24-28.

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual convention, Los Angeles, July 3-5.

NEW YORK STATE ASSOCIATION OF CITY ENGINEERS, annual meeting at Syracuse, N. Y., on June 4-5, in conjunction with the NEW YORK STATE MAYORS' CONFERENCE.

PENNSYLVANIA SEWAGE WORKS ASSOCIATION, annual meeting, State College, Pa., June 24-26.

NEW ENGLAND WATER WORKS ASSOCIATION, fall convention, Providence, R. I., Sept. 17-20.

SYRACUSE SECTION, AMERICAN SOCIETY OF CIVIL ENGINEERS on May 21 elected the following officers: president, NELSON F. PITTS; vice-presidents, FRANCIS D. MCKEON and WILLIAM F. KAVANAUGH; secretary-treasurer, G. PERRY DUNN.

MARYLAND-DELAWARE WATER AND SEWERAGE ASSOCIATION at a recent meeting elected the following officers: president, L. D. SHANK; vice-presidents, J. V. CANNEN, and E. S. HOPKINS; secretary-treasurer, A. W. BLOHM.

THE OHIO NORTHERN UNIVERSITY DISTRICT OF PROFESSIONAL ENGINEERS has organized and elected OTTO C. GOHLKE, president; C. G. KNOBLOCK, vice-president; JOHN S. SAWVELL, secretary, and GUY H. ELBIN, treasurer.

THE ENGINEERS CLUB OF ST. LOUIS at a recent meeting elected the following officers: president, E. O. SWEETSER; vice-presidents, G. H. KRAFT, H. A. BUEHLER, and E. L. OHLE; treasurer, T. J. SKINNER. W. T. CHEVALIER, vice-president of the McGraw-Hill Publishing Co., addressed the meeting.

AKRON SOCIETY OF PROFESSIONAL ENGINEERS at the annual meeting elected the following officers: HAL G. SOURS, president; FRANK B. BROWN and J. P. WALTHER, vice-presidents; A. W. CARPENTER, secretary; G. E. SODERBERG, treasurer.

PACIFIC NORTHWEST SECTION, AMERICAN WATER WORKS ASSOCIATION at the annual meeting elected the following officers: C. C. CASAD, chairman; H. H. LOBSAP, vice-chairman; E. C. WILLARD, secretary.

Personals

THOMAS C. ADAMS, associate professor of civil engineering, University of Utah, has been named as a member of the Great Salt Lake diking board.

JOHN H. KIRKWOOD, of Montesano, Wash., was recently named county engineer of Grays Harbor county, succeeding Robert L. Rowe.

PROF. KARL VON TERZAGHI, of the Technischen Hochschule, Wien, Austria, will return to this country in the spring of 1936 to deliver a series of lectures on soil mechanics at Harvard University.

JOHN L. LAMPSON, former office engineer U. S. Geological Survey in Albany, N. Y., has been transferred as assistant engineer at Asheville, N. C. HOLLISTER JOHNSON, hydraulic engineer for the PWA, will succeed to Mr. Lampson's place in Albany.

JAMES W. BRADNER, JR., town manager of Norris, Tenn., which was built by the TVA, has been appointed as manager of the construction camps at Wheeler and Pickwick dams, in addition to his present office. Mr. Bradner came to the TVA as chief highway engineer.

Brief News

FUNDS TO BUILD A SUBWAY will be sought from the $4 billion federal relief works appropriation by the Cleveland, Ohio, city council. The council authorized the creation of an advisory board to formulate a detailed plan for the project. The project would employ between 4,000 and 6,000 men for nearly two years. The subway would eliminate surface street cars from the downtown district, reducing dangerous traffic congestion.

A BILL CREATING THE CHESAPEAKE BAY BRIDGE AUTHORITY and authorizing the purchase of the Claiborne-Annapolis Ferry Co. at a price of not more than $1,200,000 and authorizing a bond issue of $10,000,000 for the construction of the span has been signed by Gov. Nice of Maryland. At the time the bill was signed the governor signed another measure requiring that the project be started within two years and limiting the period for its completion to five years.

A BILL GRANTING THE CITY OF OMAHA, Neb., authority to issue $2,000,000 of revenue bonds to purchase the Douglas Street bridge across the Missouri River owned by the Omaha & Council Bluffs Ry. Co., has been signed by Gov. Cochran. The company has asked $4,200,000 for the bridge. In anticipation of eventual purchase by the city about $2,000,000 of profits from the operation of the bridge have been placed in escrow during the past three years.

A BILL ESTABLISHING THE NEW HAMPSHIRE WATER RESOURCES BOARD has been introduced into the state legislature. The bill involves the expenditure, on a self-liquidating basis, of about $6,650,000 for storage reservoirs. It is planned to use both federal and state funds in building reservoirs at Pittsburg, Webster, Barnstead and New Ipswich. Users of released water would be charged rates to cover expenses.

ADDITIONAL FINANCING of the Colorado River aqueduct project was provided for May 10 when directors of the Metropolitan Water District of Southern California accepted a bid from the Reconstruction Finance Corporation on an $11,164,000 block of aqueduct bonds. The RFC submitted the only bid. While the bonds carry a 5 per cent interest rate, under an agreement which the district has with the RFC, the interest rate is only 4 per cent. Including this block of bonds the district has issued and sold to the RFC $53,500,000 out of the $220,000,000 authorized by member cities of the district in 1931.

THE DESIRABILITY AND POSSIBILITY of setting up a new system of municipal government for the whole Island of Montreal, on which are situated the city of Montreal, the suburban cities of Montreal West, Westmount, Outremont, and Lachine, together with many smaller municipal bodies, will be studied by a commission created by the provincial legislature. At present, the metropolitan commission of the island acts to some extent as a coordinating body, but there is a widespread advocacy of some type of borough system, embracing either the whole island, or at least the developed area which centers around the city of Montreal.

Obituary

ROBERT J. EIDLITZ, president of the construction firm of Marc Eidlitz & Son, died at his home in New York, May 17, at the age of 71. Mr. Eidlitz studied architecture in Berlin after his graduation from Cornell University in 1885.

FRANCIS S. LEHMAN, chief estimator for Todd & Brown, builders of the Rockefeller Center and Williamsburg, Va., buildings, died in Mount Vernon, N. Y., May 23. Mr. Lehman, who was 48, was a graduate of Cornell University. He had been with Todd & Brown for the past five years.

WALTER C. WHITNEY, civil engineer, died at his home in Newton, Mass., on May 20 at the age of 56. He was graduated from the Massachusetts Institute of Technology in 1899 and for ten years was on the engineering staff of the Boston & Albany R.R. He was employed by the Interstate Commerce Commission for five years on railroad valuation work, and since 1924 had been with the Associated Factory Mutual Fire Insurance Companies at Boston.

CLINTON WARD PALMER died in Pontchatoula, La., on May 22 at the age of 75. Mr. Palmer joined in gold prospecting in 1878 and later studied civil engineering. In 1882 he was a member of the engineering staff during the French attempt to cut a canal across Panama. Later Mr. Palmer was made administrator of the Chilean national railroads until 1907, subsequently returning to Chile to direct construction of another railroad.

JOHN A. PALMER, a civil engineer of Boston, died May 19 at his home in Braintree, Mass., at the age of 70. Mr. Palmer was a division engineer in charge of the construction of the first East Boston subway, and for two years was resident engineer for the state highway commission. From 1907 to 1930 he maintained offices as a construction engineer in Boston. At one time he was a partner in the engineering firm of Gow & Palmer. Mr. Palmer began engineering work in 1886 with the firm of Ernest W. Bowditch.

ADELPHUS C. TERRELL, 58, valuation engineer of the Northern Pacific Ry., died in St. Paul, Minn., May 9 after a three months' illness. Mr. Terrell graduated from Cornell University in 1900 and began his engineering work the same year as a rodman on the C. B. & Q. From 1901 to 1906 he held positions as resident engineer and division engineer with the St. Louis & San Francisco and the Rock Island railroads. He then became resident engineer for the Northern Pacific and after subsequent advances became chief valuation engineer in 1928 and held that position until his death.

CONSTRUCTION STATISTICS OF THE WEEK

ENGINEERING awards at $31,047,000 as reported by *Engineering News-Record* represent only a 4-day week, due to early closing on account of the Memorial Day holiday. Of this amount $18,711,000 is for private awards, the second highest week this year, $3,032,000 for federal work and $9,304,000 for state and municipal.

Industrial building awards at $16,358,000 are responsible for this sharp rise in private construction. All other classes in both private and public, with the exception of bridges at $1,301,000, and unclassified at $1,043,000, dropped below last week.

Among the larger contracts are included a steel strip mill, including equipment, for the Great Lakes Steel Corp., Ecorse, Mich., $15,000,000; bottling plant for the Liquid Carbonic Corp., Chicago, Ill., $500,000; highway awards by Georgia, $659,000; by Texas, $627,000; by North Carolina, $377,000; road materials for State Highway Department, New Jersey, $459,000. At Buffalo, N. Y., Erie County will purchase materials and construct bridges and culverts and resurface highways by day labor at an estimated cost of $600,000. Sewers will be constructed in the Flushing area, Queens County, to cost $598,000, by the Department of Sanitation, New York; Dover Dam at Dover, O., part of the Muskingum Valley Project, by the U. S. Engineer Office at a cost of $957,000.

New capital for the week totalled $10,290,000, of which $9,146,000 is for state and municipal bond sales and the remainder for PWA allotments and increases.

CONTRACTS
(Thousands of Dollars)

	Weekly Average May 1934	Prev. 4 Weeks	Week May 30 1935
Federal Government	$3,144	$4,314	$3,032
State and municipal	14,597	12,889	9,304
Total public	$17,741	$17,203	$12,336
Total private	5,607	5,742	18,711
Week's total	$23,348	$22,945	$31,047
Cumulative to date:			
1934...$602,981,000	1935...$547,110,000		

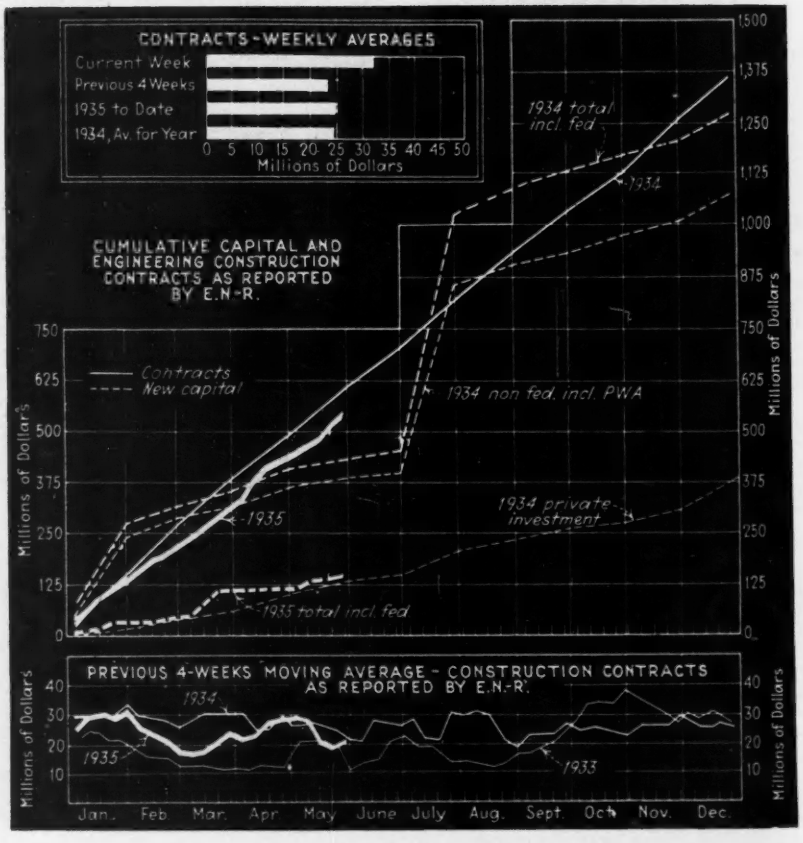
NEW PRODUCTIVE CAPITAL
(Thousands of Dollars)

1935	Week May 30	Cumulative
State and municipal	$9,146	$171,600
PWA allotments, S&M	.....	—49,032
RFC loans, S&M	.....	84
Corporate issues	.....	.....
PWA allotments, private	.....	8,619
Total, Non-Federal	$9,146	$131,271
PWA allotments, Federal Constr.	1,144	11,051
Total new capital	$10,290	$142,322
Cumulative to date:		
1934...$429,949,000	1935...$142,322,000	

Note: These figures include private bonds, and stocks sold for productive purposes; state and municipal bonds for construction; PWA loans and grants to states and municipalities, including the special highway funds; PWA private loans, and allotments for Federal construction. Negative amounts in PWA totals indicate excess of rescissions and reductions over reallotments and increases in outstanding allotments.

INDEX NUMBER

E.N.R.-Cost	1913 = 100	1926 = 100	E.N.R.-Volume	1913 = 100	1926 = 100
May, 1935	194.06	93.28	Apr., 1935	130	57
Apr., 1935	194.50	93.49	Mar., 1935	106	44
May, 1934	199.61	95.95	Apr., 1934	109	48
1934 (Av.)	198.10	95.23	1934(Av.)	114	50
1933 (Av.)	170.18	81.80	1933(Av.)	102	47
1932 (Av.)	156.97	75.45	1932(Av.)	127	56


CONTRACTS - WEEKLY AVERAGES
Current Week
Previous 4 Weeks
1935 to Date
1934, Av. for Year
0 5 10 15 20 25 30 35 40 45 50
Millions of Dollars
CUMULATIVE CAPITAL AND ENGINEERING CONSTRUCTION CONTRACTS AS REPORTED BY E.N.-R.
Contracts
New capital
1934 total incl. fed
1934
1934 non fed. incl. PWA
1935
1934 private investment
1935 total incl. fed
Millions of Dollars
PREVIOUS 4-WEEKS MOVING AVERAGE - CONSTRUCTION CONTRACTS AS REPORTED BY E.N.-R.
1934
1935
1933
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.